SERVICE MANUAL

FOR

MODEL 902 AUTOMATIC

ANALYZER

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MODEL 902 AUTOMATIC ANALYZER

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1. PRODUCT SPECIFICATIONS

1.1 Overall System

Configuration	:	Console type automatic analyzer, with analytical and operation units integrated		
Principle	:	Discrete type, random access, single-line multi-analysis system; entire reaction monitoring system		
Analytical methods	:	Colorimetry (absorbance measurement), ion selective electrode method (ISE; option)		
Throughput	:	Colorimetry	;	200 tests/hr (Photometry only max. 300 tests/hr inclusive of ISE)
No. of analysis items	:	Colorimetry	;	36
		ISE	;	3 (Na, K, Cl)
		Serum indexes	;	3
		Calculation items	;	8
Reaction time	:	10 minutes max.; 3, 4, 5, 10 minutes for concentration calculation (same as Model 7070/7170)		
Measurable samples	:	Serum (or blood plasma) and urine; one sample kind per channel		
Application	:	Emergency (stat) and routine analyses		
Test item selection	:	Via entry from operation panel, entry from system interface, entry from no. of items settable (11 kinds)		

1.2 Sampling System

Sample container	:	Hitachi standard sample cup Sample tube ; diameter 13 to 17 mm length 75 to 100 mm
Sample disk	:	60 positions Outer row; 35 positions (routine and stat samples) (with free adapter, barcode reader attachable) Inner row; 25 positions (standard + control samples (22), rinse solutions (3))
Detergents	:	3 kinds (W1 ; for sample probe rinsing) HITERGENT (W2 ; for sample carryover evasion) ISE RINSE SOLUTION (W3 ; for sample carryover evasion) HICARRYNON
Sampling mechanism	:	Pipetter driven by stepping motor 2 to 50 μL of sample/test (in 0.1 μL steps)
Pipetting mode	:	Normal ; prescribed volume discharged at cell bottom Aqueous sample ; system water solution for sample probe internal rinsing usable as STD-1 Sample pre-dilution not performed
Insufficient sample detection	:	Resistance detection method
Sample ID	:	Barcode reader (option) Following code shemes are usable in combination; CODE 39, CODE 128, INTERLEAVED 2 OF 5, NW7 (Modulas 10, Modulas 16)
Automatic rerun	:	Auto rerun function not provided
Stat sample analysis	:	Routine sample analysis interruptible for stat sample analysis
Sample carryover	:	Sample carryover evasion function available; 2 kinds of detergents settable on sample disk inner row
Sample conveyance	:	Can be sampled directly from belt-line

1.3 Reagent System

Reagent disk	:	One disk, 40 positions (20 positions each on inner and outer rows)
Reagent cooling	:	Cooling water circulating system (3 to 15°C) (option for China-destined instrument)
Reagent bottle	:	50 mL, 20 mL (adapter necessary) (without barcode, concentrated reagent unusable)
Detergents	:	HITERGENT (50 mL); position 40 (fixed) (for addition to reaction bath) Detergent 1 ; for reagent probe, stirring rod rinsing, reagent probe carryover evasion, reaction cell carryover evasion Detergent 2 ; for reagent probe carryover evasion, reaction cell carryover evasion (settable on reagent disk inner row)
ISE reagent	:	Internal standard solution (position 37 (fixed)) Diluent (position 38 (fixed))
Pipetting mechanism	:	Pipetter driven by stepping motor; 20 to 350 μL/test (in 1 μL steps)
Reagent addition timing	:	3 steps (0, 1.5 and 5 minutes); throughput is maintained even when adding 3 reagents.
Carryover evasion	:	Rinsing for carryover evasion possible; throughput may decrease by specifying carryover evasion.

1.4 Reaction System

Reaction disk	:	Turntable type disk (10-minute reaction per rotation)
Reaction cell	:	Optical path length 6 mm (area 6 × 5 mm)
No. of reaction cells	:	48
Reaction cell control	:	One rotation + one pitch feed (18 seconds)
Sample pipetting position	:	One position (fixed)
Reagent pipetting position	:	One position (fixed)
Reaction temperature	:	37 ± 0.1°C (warm water circulating system)
Stirring	:	By means of stirring rod rotation Timing for stirring; after each addition of R1,R2,R3 Stirring possible for a minimum volume of 100 μL
Stirring position	:	One position (fixed)
Reacting solution volume	:	Minimum ; 250 μL (minimum required volume for photometry) Maximum ; 500 μL (temperature control, rinsing upper limit)
Photometric position	:	One position (fixed)
Cell rinsing	:	After completion of photometry (rinsing 3 times; rinsing with detergent not performed)
Carryover evasion	:	Rinsing for carryover evasion possible; throughput may decrease by specifying cell carryover evasion

1.5 Photometric System

Photometer	:	Multiwavelength photometer (absorptiometry)
Wavelengths	:	12 wavelengths (340, 376, 415, 450, 480, 505, 546, 570, 600, 660, 700, 800 nm)
Monochromator	:	Grating
Detector	:	Photodiode
Linearity	:	Up to 2.5 Abs (10 mm cell conversion)
Photometric method	:	Direct photometry of reaction cell (at one or two wavelengths)
Correction	:	Cell blank correction prior to analysis (passed cell blank measurement alone)

1.6 ISE (option)

Electrodes	:	Flow cell type, liquid-membrane ISE cartridge
Reference electrode flow path	:	1 MKCL, liquid flow path
Measuring temperature	:	36°C ± 2°C (warm water circulating system)
System	:	Indirect (dilution) potentiometry, 50-times dilution
Measuring cycle	:	36 sec/sample (18 sec for sample, 18 sec for internal standard solution)
Measured items	:	Na, K, Cl
Measurable samples	:	Serum and urine
Linearity	:	Na ; 10 to 250 mmol/L K ; 1 to 100 mmol/L Cl ; 10 to 250 mmol/L
Reagent bottle	:	Internal standard solution ; 50 mL max. Diluent ; 50 mL max. Reference electrode solution ; 500 mL max.

1.7 Installation Conditions

Power requirement	:	230 V, 50/60 Hz, less than 1.5 kVA
Deionized water consumption	:	Less than 15 L/hr
Waste liquid drain	:	2 systems (for concentrated and diluted liquids)
Ambient temperature/humidity	:	Temperature ; 18 to 30°C Humidity ; 20 to 80% (non-condensing)
Analyzer dimensions	:	720 W × 720 D × 1085 H mm
Analyzer weight	:	Within 200 kg
BTU	:	1300 kcal/hr max.
Noise (mean) in operation	:	< 55 dB

1.8 User Interface

Application	:	Routine analysis for Asia version
Display	:	Backlighted LCD; 256 × 128 dots, graphic
Keyboard	:	Touch screen keys (72 keys)
Printer	:	Thermal roll-paper printer (20 digits)
Multi-language compatibility	:	Display ; Japanese/English/Chinese/German/Spanish applicable Printer ; English alone

1.9 Deionised Water

Pressure : 0.5 to 3.5 kgf/cm^2

Conductivity : 1 μs/cm or less, germ-free

1.10 Analytical Methods

Assay modes	:	One-point One-point end (+ prozone check) Two-point rate Two-point end (+ prozone check) Three-point two-item One-point rate two-item Rate A (+ sample blank correction) Rate A (+ serum indexes) Rate B two-item (same wavelength) Rate B two-item (different wavelengths) ISE
Data alarms	:	Based on Model 7070/7170
Standard solution	:	22 kinds max. (positions to be shared with control sera)
Calibration types	:	Linear (2-point linear) K factor 4 parameter LOGIT-LOG 5 parameter LOGIT-LOG Spline Segmented line
Calibration method	:	At startup only; all points (FULL) and reagent-blank-corrected calibration
Calculation channels	:	For 8 channels
Test-to-test compensation	:	For 8 channels

1.11 Accuracy Control

Control serum	:	5 kinds max. (positions shared with standard solutions)

1.12 Data Storage

Routine sample data	:	400 samples (in data disk)
Stat sample data	:	50 samples (in data disk)
Control sample data	:	5 kinds $\times$ 30 (in SRAM)

1.13 System Interface

Interface	:	RS-232C and current loop
Communication protocol	:	Based on Model 7070/7170
Communication details	:	Communication with host; communication details based on Model 7070/7170

1.14 Options for Analyzer

ISE

Sample ID accessory	:	Model	;	BL180
		Maker	;	Keyence
		Barcode spec.	;	CODE 39, ITF, NW7 (Modulas 10, Modulas 16), CODE 128

2. TROUBLESHOOTING

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2. TROUBLESHOOTING

2.1 Alarm Code Table

Category	Alarm Name		Category	Alarm Name
1	STIRRER		38	VAC. TANK
2			39	
3	RINSE		40	
4			41	LAMP
5	R.DISK		42	
6	S.PROBE		43	
7			44	
8	S.DISK		45	CELL BNK1
9			46	CELL BNK2
10			47	ADC1 ?
11	S. SHORT		48	ADC2 ?
12			49	ADC3 ?
13			50	BARCODE 1
14			51	
15	S. SYRINGE		52	
16	REAG. PROBE		53	
17			54	BARCODE 2
18	REAG. DISK		55	
19			56	
20			57	REAG. SHORT
21			58	
22	R. SYRINGE		59	REAG. LEVEL
23			60	
24	ISE SIPPER		61	
25			62	
26	ISE SYRING.		63	
27	ISE STOP ?		64	
28	TEMP CONT.		65	
29	INC. WATER		66	
30	REF. WATER		67	TS OVER
31	DIST. WATER		68	PATNT OVER
32	DIST. SENS.		69	SAMP. END
33			70	
34	RESERVOIR		71	DC POWER
35			72	FUSE
36			73	POWER FAIL
37	SIPPER		74	

(cont'd)

Category	Alarm Name		Category	Alarm Name
75	MOTOR CONT.		114	ACI ERROR
76	MOTOR TOUT		115	
77			116	
78			117	
79			118	
80			119	FD WRITE ?
81			120	FD READ ?
82			121	NO FD
83	STANDARD ?		122	
84	CALIB.		123	FD PROTECT
85	CALIB. SD ?		124	
86	SENS. ?		125	PRINTER
87			126	SYSTEM I/F
88			127	
89			128	
90	ISE LEVEL		129	
91	ISE NOISE		130	WATER EXG.
92	ISE PREP.		131	
93	ISE SLOPE		132	
94	ISE I. STD		133	
95	REF. SHORT		134	
96	TWIN TEST ?		135	
97			136	
98	CHEM. PARAM ?		137	
99	CLB. PARAM ?		138	
100	VOLUME ?		139	
101			140	PANEL I/F
102			141	REAGNT ?
103	CMP. TEST ?		142	
104	S. INDEXES ?		143	
105			144	
106	ON BOARD ?		145	CELL C. O.
107	REAG. POS ?		146	ISE C. O.
108	CLB (IS) POS		147	
109			148	
110			149	
111			150	
112			151	
113			152	

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
1 to 8	STIRRER	1	1	STOP	In ascending action of the stirrer, it does not reach the upper dead point (on the rinsing bath side). (Alarm at the first upper dead point after resetting will be issued from other than the cell side.)	Check the upper dead point detector.
		1	2	STOP	In ascending action of the stirrer, it does not reach the upper dead point (on the cell side).	Same as above
		1	3	STOP	In descending action of the stirrer, it does not leave the upper dead point.	Same as above
		1	4	STOP	When the stirrer moves toward the rinsing bath, it does not reach the rinsing bath position.	Check the home detector.
		1	5	STOP	The stirrer does not come to the cell position.	Check the detector on the cell side.
		1	6	STOP	At resetting, the stirrer does not reach the rinsing bath position (home position) in its return movement to the home position.	Check the home detector.
		1	7	STOP	At resetting, the stirrer does not leave the rinsing bath position (home position) in its departing movement from the home position.	Same as above
		1	8	STOP	In rotation of the stirrer, it is not set at the upper dead point.	Check the upper dead point detector.
21,22	RINSE	3	1	STOP	The rinsing mechanism does not reach the upper dead point in ascending motion.	Check the upper dead point detector.
		3	2	STOP	The rinsing mechanism does not leave the upper dead point in descending motion.	Same as above

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
61 to 65	R. DISK	5	1	STOP	The reaction disk cannot recognize its stop position.	Check the detectors for stop positions on the inner and outer tracks.
		5	2	STOP	The reaction disk does not stop at the specified position.	Same as above
		5	3	STOP	At resetting, the reaction disk cannot recognize its home position.	Check the home detector.
		5	4	STOP	At resetting, the first cell on reaction disk does not stop at the specified position.	Check the home detector or inner/outer track detector.
		5	5	STOP	When the reaction disk turns, the serum probe, reagent probe, stirrer or rinsing mechanism is not set at the upper dead point (on the cell side). (When this alarm is issued, another alarm (on rinsing or stirring mechanism) may concur.)	(1) Perform resetting. (2) Check the upper dead point detector of the mechanism which caused alarm.
71	SAMPLE PROBE	6	1	S.STOP/ STOP **(Note 1)**	The serum probe does not reach the upper dead point in ascending motion (on other than the cell side). (Alarm at the first upper dead point after resetting will be issued from other than the cell side.)	Check the upper dead point detector.
72 to 85	SAMPLE PROBE	6	2	STOP	The serum probe does not reach the upper dead point in ascending motion (on the cell side).	Same as above
		6	3	S.STOP/ STOP **(Note 1)**	The serum probe moves down abnormally in descending action (on other than the cell side). (±3 mm from cup bottom, 0 to 4 mm from cell bottom)	(1) Check the liquid level detector. (2) Replace the liquid level detector PC board.
		6	4	STOP	The serum probe moves down abnormally in descending action (on the cell side).	Same as above
		6	5	S.STOP/ STOP **(Note 1)**	The serum probe does not go down from the upper dead point in descending motion.	Check the upper dead point detector.

NOTE: 1. S.STOP may be issued only during operation.

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
72 to 85	SAMPLE PROBE	6	6	STOP	The serum probe does not go down from the upper dead point in descending motion (on the cell side).	Check the upper dead point detector.
		6	7	S.STOP/ STOP **(Note 1)**	Detection of abnormal descending motion of the serum probe remains on.	Refer to alarm code 6-3.
		6	8	S.STOP/ STOP **(Note 1)**	When serum probe turns to the cell side, the cell position cannot be detected.	Check the home detector.
		6	9	S.STOP/ STOP **(Note 2)**	When the serum probe turns from the cell side to other position, it does not come off the cell position.	Same as above
		6	11	S.STOP/ STOP **(Note 1)**	Before the probe goes down, the liquid level detector is already turned on.	Refer to alarm code 6-3.
		6	12	WARNIN G	The serum probe moves down abnormally in descending action (only at turning of the serum probe in adjustment).	Same as above
		6	13	S.STOP/ STOP (**Note 2)**	In rotation of the serum probe, it is not set at the upper dead point.	Check the upper dead point detector.
		6	14	STOP	In rotation of the serum probe from the reset position, it does not come off the reset position.	Check the home detector.
		6	15	STOP	In rotation of the serum probe to the reset position, it cannot detect the reset position.	Same as above
101 to 106	SAMPLE DISK	8	1	S.STOP/ STOP (**Note 2)**	The sample disk cannot detect the stop position on outer track.	Check the outer track detector.
		8	2	S.STOP/ STOP (**Note 2)**	The sample disk does not stop at the specified position on outer track.	Same as above
		8	3	S.STOP/ STOP (**Note 2)**	The sample disk cannot detect the stop position on inner track.	Check the inner track detector.
		8	4	S.STOP/ STOP (**Note 2)**	The sample disk does not stop at the specified position on inner track.	Same as above

NOTE: 2. S.STOP may be issued only during operation.

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
101 to 106	SAMPLE DISK	8	5	STOP	At resetting, the sample disk cannot detect the home position.	Check the home detector.
		8	6	STOP	At resetting, the sample disk does not stop at the specified point of home position.	Same as above
107	SAMPLE DISK	8	7	STOP	At resetting, the sample disk does not leave the home position.	Check the home detector.
251 to 310	SAMPLE SHORT	11	1 to 60	WARNING	In sipping from the sample cup, sample on the sample disk is inadequate. (Sub-code groups Routine/ stat samples : 1 to 35 Control STD : 36 to 57 W1 to W3 : 58 to 60)	Add sample.
551 to 552	SAMPLE SYRINGE	15	1	S.STOP/ STOP	The serum syringe does not reach the upper dead point.	Check the upper dead point detector.
		15	2	S.STOP/ STOP	The serum syringe does not go down from the upper dead point.	Same as above
561 to 568	REAGENT PROBE	16	1	STOP	The reagent probe does not reach the upper dead point in ascending motion.	Check the upper dead point detector.
		16	2	STOP	The reagent probe moves down abnormally in descending motion.	Check liquid level detection.
		16	3	STOP	The reagent probe does not go down from the upper dead point in descending motion.	Check the upper dead point detector.
		16	4	WARNING	Detection of abnormal descending motion of the reagent probe remains on.	Check the descending error detector.

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
561 to 568	REAGENT PROBE	16	5	STOP	When the reagent probe turns toward the cell, it cannot detect the cell position.	Check the home detector.
		16	6	STOP	When the reagent probe turns from the cell side to other position, it does not leave the cell position.	Same as above
		16	7	STOP	Before the probe goes down, the liquid level detector is already turned on.	Check liquid level detection.
		16	8	STOP	In rotation of the reagent probe, it is not set at the upper dead point.	Check the upper dead point detector.
581 to 593	REAGENT DISK	18	1	STOP	The stop position of reagent disk cannot be detected.	Check home detection or count detector.
		18	2	STOP	The reagent disk does not stop at the specified position.	Same as above
		18	3	STOP	The home position of reagent disk cannot be detected.	Check home detection.
621 to 622	REAGENT SYRINGE	22	1	STOP	The reagent syringe does not reach the upper dead point.	Check the upper dead point detector.
		22	2	STOP	The reagent syringe does not move down from the upper dead point.	Same as above
641	ISE SIPPER	24	1	STOP	The sipper nozzle does not reach the upper dead point (during resetting/ operation).	Check the upper dead point detector of ISE sipper.
642	ISE SIPPER	24	2	WARNING/ STOP **(Note 4)**	The sipper nozzle does not leave the upper dead point.	Same as above
661 to 662	ISE SYRNG	26	1	WARNING/ STOP **(Note 4)**	The sipper syringe does not reach the upper dead point.	Check the upper dead point detector of ISE Syringe.
		26	2	WARNING/ STOP **(Note 4)**	The sipper syringe does not leave the upper dead point.	
671	ISE STOP OK ?	27	1	WARNING/ STOP **(Note 4)**	The ISE function is stopped due to alarm. (This warning is indicated when restart in the sampling stop status was attempted.)	Check alarm log and deal with the alarm.

NOTES: 3. S.STOP may be issued only during operation.
4. Though the photometry assay function works, the ISE function does not work.

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
681	TEMP CONTROL	28	1	WARNING	The water temperature of incubation bath is higher than 45.0°C.	Check the thermistor or thermostat of heater.
		28	2	WARNING	The water temperature of incubation bath is outside a range of 37 ± 0.5°C. (This is checked only at operation.)	Same as above
691	INCUBA-TOR WATER	29	1	WARNING	The water level of incubation bath is too low.	Replenish water or check the drain solenoid valve.
701	REF WATER	30	1	WARNING	A period of 24 hours has passed since exchange of incubation bath water.	Exchange incubation bath water.
711	DISTILLED WATER	31	1	STOP	The water level of distilled water tank is too low. (This alarm will not be issued during initialization and water exchange.)	Check the water level sensor.
712	DIST WATER	31	2	WARNING	The water level of distilled water tank is too low.	Same as above
721	DIST WATER SENSOR	32	1	WARNING	The water level sensor in distilled water tank is abnormal.	Check float switch.
724	RESER-VOIR	34	1	WARNING	The waste solution reservoir is full.	Check waste solution tank detection.
771	SIPPER	37	1	STOP	The negative pressure of vacuum pump is too low.	Check vacuum level at vacuum suction.
781	VACUUM TANK	38	1	WARNING	Water is accumulated in the vacuum tank.	Check SV12 or SV14.
811 to 813	PHOTOME-TER LAMP	41	1	WARNING	In passed cell blank measurement, a value of more than 3.3 Abs is indicated in any one of 4 measurements. (3 times or less)	(1) Replace light source lamp. (2) Check 12 V power supply.
		41	2	S.STOP (Restart un-allowable)	In passed cell blank measurement, a value of more than 3.3 Abs is indicated for all of ADC1, ADC2 and λ_1 to λ_{12}.	
		41	3	S.STOP (Restart un-allowable)	The above alarm code 41-1 is issued 10 times consecutively.	

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
1231	CELL BLANK	45	1	S.STOP (Restart un-allowable)	In passed cell blank measurement, any one of ADC1, ADC2, λx and λy differs from the reference value (Note 5) by more than 0.1 Abs through 10 consecutive cycles. (Counting is not made in use for stopped cell blank test.)	(1) Carry out cell washing. (2) Replace the cell.
1241 to 1400	PASS CELL BLANK	46	1 to 48	WARNING	In 4 passed cell blank measurements, any one of ADC1, ADC2, λx and λy differs from the reference value (Note 5) by more than 0.1 Abs twice or more. (In case any one of those values differs only once, the average value of normal data is treated as a value of passed cell blank.)	Same as above
1441 to 1444	ADC1?	47	1	WARNING	Any one of I/O error, boundary error of parameter block pointer, I/O device busy, channel error and I/O device error (PC board not mounted, device inoperable, time-out) has occurred.	Replace ECPU230 or EMIO100 PC board.
		47	2	WARNING	• A/D count value remains at 0. • After A/D conversion, interruption is impossible. • The command or parameter given to A/D PC board is abnormal. • A/D conversion cannot be completed. (Time-out occurs.) (Reference voltage is checked.)	(1) Replace Log Amp PC board. (2) Check 2 V and 6 V reference voltages.
		47	3	WARNING	The number of A/D starts cannot be reset to 0. (This is checked at reaction measurement.)	Same as above

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
1441 to 1444	ADC1?	47	4	WARNING	• A/D count for 2 V is abnormal. • A/D count for 6 V is abnormal. Normal count for 2 V (7547 < count value < 8341) Normal count for 6 V (22460 < count value < 25023) (This is checked at measurement of reference voltage.)	Same as above
1451 to 1453	ADC2?	48	1	WARNING	Refer to alarm code 47-1.	Replace ISE AMP PC board.
		48	2	WARNING	Refer to alarm code 47-2.	Same as above
		48	3	WARNING	Refer to alarm code 47-4. Reference voltage for ISE: 2 V and 8 V Normal count for 2 V (7547 < count value < 8341) Normal count for 8 V (30184 < count value < 33364) Normal offset value (22811 < count value < 40547)	Same as above
1461 to 1462	ADC3?	49	1	WARNING	Refer to alarm code 47-2.	Replace EMIO100 PC board.
		49	2	WARNING	• A/D count for 2 V is abnormal. • A/D count for 6 V is abnormal. Normal count for 2 V (12452 < count value < 13763) Normal count for 6 V (37356 < count value < 41288)	Same as above
1471 to 4506	BARCODE1	50	1 to 35	WARNING	Data reception from the barcode reader has not been completed before ID reception time-out. (Sub-code indicates the position No. on disk.)	Replace the label or barcode reader.

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
1801 to 1805	BARCODE2	54	1 to 5	WARNING	An error has occurred in communication with the barcode reader. (Parity error, framing error or overrun error) Sub-code indication 1 : Unassigned 2 : Unassigned 3 : Sample disk barcode reader 4 : Unassigned 5 : Unassigned	Check the communication cable of barcode reader.
1931 to 1971	REAGENT SHORT	57	1 to 40	WARNING	• The volume of reagent to be sipped from a reagent bottle is inadequate. • The reagent volume is a total amount of one kind of reagent for each test item. (1) Sub-code indicates position No. (2) Positions 37 and 38 are used for ISE. (3) Position 40 is used for HITERGENT. (4) Position 39 is used for HIALKALI.	Set new reagent.
2231 to 2271	REAGENT LEVEL	59	1 to 40	WARNING	Reagent volume is smaller than the remaining reagent check value specified with system parameter.	Set reagent newly.
2781 to 2830	UN-ASSIGNED					
2851, 2852	TS OVER	67	1	WARNING	Because 400 samples are registered in routine sample test selecting information, new test selecting information cannot be registered from the host.	After completion of analysis, register TS again.
2861	PATIENT SAMPLE OVER	68	1	WARNING	Because 400 samples are registered in routine sample test selecting information, a new routine sample cannot be analyzed.	Same as above

(cont'd)

<table>
<tr><th>Alarm Control No.</th><th>Alarm</th><th>Category</th><th>Sub-code</th><th>Level</th><th>Description</th><th>Remedy</th></tr>
<tr><td rowspan="5">2891 to 2894</td><td rowspan="5">DC POWER</td><td>71</td><td>1</td><td>STOP</td><td>15 V DC power supply is abnormal.</td><td>Replace the ±15 V power supply module.</td></tr>
<tr><td>71</td><td>2</td><td>STOP</td><td>-15 V DC power supply is abnormal.</td><td>Same as above</td></tr>
<tr><td>71</td><td>3</td><td>WARNING</td><td>12 V lamp power supply is abnormal.</td><td>Replace the 12 V power supply.</td></tr>
<tr><td>71</td><td>4</td><td>STOP</td><td>5 V power supply is abnormal.</td><td rowspan="2">5 V for other than CPU board</td></tr>
<tr><td>71</td><td>11</td><td>E.STOP</td><td>24 V DC</td></tr>
<tr><td>2911</td><td>FUSE</td><td>72</td><td>1</td><td>E.STOP</td><td>AC fuse has blown.</td><td>Replace the F3 fuse.</td></tr>
<tr><td>2921</td><td>POWER FAIL</td><td>73</td><td>1</td><td>WARNING</td><td>Power supply to the instrument is interrupted</td><td>Check power supply.</td></tr>
<tr><td>2941 to 2973</td><td>MOTOR CONTROL-LER</td><td>75</td><td>1 to 18</td><td>STOP</td><td>Data cannot be written into the motor controller.</td><td>Replace ECPU230.</td></tr>
<tr><td>2991 to 3023</td><td>MOTOR TIMEOUT</td><td>76</td><td>1 to 18</td><td>E.STOP</td><td>Motor operation was abnormal. Error has been detected in the time-out check of motor controller.

<table><tr><th>Sub-code</th><th>Motor</th></tr><tr><td>1</td><td>Reaction disk</td></tr><tr><td>2</td><td>Sample disk</td></tr><tr><td>3</td><td>Reagent disk</td></tr><tr><td>4</td><td>Rinsing mechanism up/down</td></tr><tr><td>5</td><td>Sample arm up/down</td></tr><tr><td>6</td><td>Sample arm rotation</td></tr><tr><td>7</td><td>Reagent arm up/down</td></tr><tr><td>8</td><td>Reagent arm rotation</td></tr><tr><td>9</td><td>Stirrer up/down</td></tr><tr><td>10</td><td>Stirrer rotation</td></tr><tr><td>11</td><td>ISE sipper up/down</td></tr><tr><td>12</td><td>(Unassigned)</td></tr><tr><td>13</td><td>Serum syringe</td></tr><tr><td>14</td><td>Reagent syringe</td></tr><tr><td>15</td><td>ISE syringe</td></tr><tr><td>16</td><td>(Unassigned)</td></tr><tr><td>17</td><td>GMCNT</td></tr><tr><td>18</td><td>(Unassigned)</td></tr></table></td><td>(1) Replace ECPU230.
(2) Check the mechanism which caused alarm.</td></tr>
</table>

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
3101 to 3189	STANDARD?	83	1 to 40 (ch.)	WARNING	<<Photometry assay>> (1) In calibration, the STD absorbance data is indicated with alarm. (2) In calibration, data calculation is disabled. <<ISE assay>> (1) In calibration, the potential data of standard or internal standard solution is indicated with ADC error, insufficient sample alarm, noise alarm or level alarm. (2) In calibration, data calculation is disabled. (The result of calibration is not updated nor saved onto FD.)	(Photometry assay) • Replace STD sample. • Check the concentration parameter. (ISE assay) Same as above
3251 to 3291	CALIBRA-TION	84	1 to 40 (ch.)	WARNING	<<Photometry assay>> The factor value 'K' determined in calibration differs from the previous value by more than ±20%. <<ISE assay>> The calibrator concentration value and slope value determined in calibration differ from the previous values by more than the compensation limit (%).	(Photometry assay) (ISE assay) Same as above
3401 to 3438	CALIB.SD?	85	1 to 36 (ch.)	WARNING	The mean error determined in multi-point calibration is larger than the SD limit (input value).	Replace STD and check again.

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
3551 to 3588	SENSITIV-ITY?	86	1 to 36 (ch.)	WARNING	In linear (with 2 to 6 points) or nonlinear calibration, a difference between the mean STD (1) absorbance and the mean STD (N) **(Note 7)** absorbance is smaller than the sensitivity limit (input value). **NOTES :** 7. N: = 2 for linear (2points) = 2 to 6 for nonlinear and linear (3 to 6 points) (Span point input value) 8. If either STD (1) or STD (N) alone has been measured, the absorbance value of the other STD is checked using the previous data.	The result of calibration is not updated nor saved onto FD.
4151 to 4153	ISE LEVEL	90	1	WARNING	The mean potential value (EAV) at three out of five measurement points of internal standard solution is outside the following range. (Internal standard) Na : -90.0mV ≤ EAV ≤-10mV ⇒OK	(1) Replace STD and carry out calibration. (2) Replace the Na electrode.
		90	2	WARNING	K : -90.0mV ≤ EAV ≤ -10mV ⇒OK	(1) Same as above (2) Replace the K electrode.
		90	3	WARNING	Cl : 100.0mV ≤ EAV ≤ 180.0mV ⇒OK	(1) Same as above (2) Replace the Cl electrode.
4161 to 4163	ISE NOISE	91	1	WARNING	A difference (FIV) between maximum and minimum potential values at three of five measurement points of internal standard solution is outside the following range. (Internal standard, sample) Na : 0.7mV < FIV(2) - FIV(4)	Carry out reagent priming and check for bubble formation.
		91	2	WARNING	K : 1.0mV < FIV(2) - FIV(4)	Same as above
		91	3	WARNING	Cl : 0.8mV < FIV(2) - FIV(4)	Same as above

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
4171 to 4173	ISE PREP.	92	1	WARNING	Upon calibration, the slope value is within the following range. Na : 45.0mV ≤ Slope value ≤ 49.9mV or 68.1mV ≤ Slope value	• Make sure that the standard solution and reagent are set properly. • Make sure that the standard solution is free from concentration or deterioration. • Make sure that the electrodes (Na, K, Cl) are within their guaranteed life.
		92	2	WARNING	K : 45.0mV ≤ Slope value ≤ 49.9mV or 68.1mV ≤ Slope value	
		92	3	WARNING	Cl : -39.9mV ≤ Slope value ≤ -35.0mV or -68.1mV ≥ Slope value	
4181 to 4183	ISE SLOPE	93	1	WARNING	(1) In the result of calibration, the slope value is within the following range. (2) The response characteristic of electrode is poor (in case carry-over rate (A) is as indicated below). Na : (1)SLOPE < 45.0mV (2)0.232 < A	Refer to alarm codes 92-1 to 3.
		93	2	WARNING	K : (1)SLOPE < 45.0mV (2)0.160 < A	Same as above
		93	3	WARNING	Cl : (1)SLOPE < -35.0mV (2)0.490 < A	Same as above
4191 to 4193	ISE I.STD	94	1	WARNING	The concentration of internal standard solution (C(IS)) is within the following range. Na : C(IS) < 120.0mEq/L or 160.0mEq/L < C(IS)	(1) Replace STD and carry out calibration again. (2) Replace the internal standard solution.
		94	2	WARNING	K : C(IS) < 3.0mEq/L or 7.0mEq/L < C(IS)	Same as above
		94	3	WARNING	Cl : C(IS) < 80.0mEq/L or 120.0mEq/L < C(IS)	Same as above

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
4201 to 4203	ISE REAGENT SHORT	95	1		Unassigned (Liquid level detection for IS/DIL solution)	Replace the reference electrode solution with new one. Check the ISE reagent volume.
		95	2		Unassigned (Same as above)	
		95	3	WARNING	The volume of reference electrode solution is 30 mL or less.	
4211	TWLN TEST?	96	1 to 36 (ch.)	WARNING	(1) when analyzing two tests at a time, the assigned method for the corresponding test is inadequate. (2) Assignment of the corresponding test is being done or not being done when analysis for two tests is not being made at the same time. (3) When analyzing two tests at the same time, the analytical parameters are not identical. Sub-codes (1 to 36) signify the channel numbers.	• Start setting in order from the tests that are designated by the Measured Point of the first half of the 1 channel 2 Test Analysis Method (3 Point, 1 Point and Rate, Rate B) • When not analyzing two tests at the same time, do not designate 'Two Test Analysis' for the Analysis Parameter. • With the Analysis Parameter screen for the applicable test, unify all the parameters below for the Simultaneous 2 Test Analysis Test. • Analytical Method • Reaction Time • Sample Volume • Reagent Pipetting volume (R1-R3) • Calibration Method • Calibration Point • Standard solution volume • Standard solution position

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
4511 to 4548	CHEMISTRY PARAME-TER?	98	1 to 36 (ch.)	WARNING	(1) The relationship between assay code and photometric point is improper. (2) The assigned photometric point lags behind the specified reaction time. (Operation is impossible.)	Correct the parameter.
4661 to 4698	CALIBRA-TION PARAME-TER CALIB.	99	1 to 36 (ch.)	WARNING	(1) The relationship between assay code and calibration type is improper. (2) Necessary calibration points for calibration type are not input. (3) Necessary standard positions for calibration are not input. (4) The relationship between calibration type and calibration method is improper. (5) The standard concentration values are not set in ascending order. (Except for STD (3) and (4) for isozyme) (6) Concentration value is not zero when '99' is entered for POS. of STD (1). 1. The photometry assay data in other than manual mode is checked. 2. Operation is unallowable. 3. Check in (4) is made with regard to specifications of time-out calibration, lot-to-lot calibration, bottle-to-bottle calibration and test selecting information.	Check parameter and input it again.

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
4811 to 4848	VOLUME CHECK?	100	1 to 36 (ch.)	WARNING	(1) The total reagent volume up to the last photometric point is more than 250 to 500 µL. (2) The volumes of reagents 1 to 3 are all zero. (3) The reagent volume having a timing behind the reaction time is not zero. (4) The total liquid volume of sample and reagent is less than 250 µL. 1. When '999' (stirring only) is specified for reagent volume, 0 µL is taken for the volume. However, when '999' is specified for the reagent volume having a timing behind the reaction time, an error occurs. 2. Operation is unallowable. 3. The final liquid volume is a total volume of sample and reagent within 250 to 500 µL.	Check parameter. If the improper condition indicated by alarm can be detected, correction and reentry are required.
5261	CMP. TEST	103	1 to 8	WARNING	The setting of formula number corresponding to the relevant code is improper. (1) An unmeasurable test is specified for compensation. (2) A compensated test is not included in the formula. (3) In photometry assay for compensated test, the electrolyte parameter is specified.	Call up calculation item screen and check the compensation formula on it.

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
5271 to 5356	SERUM INDEXES?	104	1 to 36 (ch.)	WARNING	(1) Although the sub-code corresponds to the serum index measurement test, the rate-A assay is not assigned. (2) Although the sub-code corresponds to the serum index measurement test and sample blank is to be corrected, reagent 2 discharge is specified. (Analysis does not start.)	Check parameter for serum indexes.
5431	ON BOARD?	106	1	WARNING	There is no measurable channel. There is no channel for which necessary reagent has been prepared. (Analysis does not start.)	Check each parameter.
5441	REAG.POS?	107	1 to 38	WARNING	(1) The reagent position specified for a photometry assay is also specified for other photometry assay. (2) The same reagent position is specified for both carry-over cleaning agent and photometry assay or ISE test. (Analysis does not start.)	Check each reagent.
5481	CLB(IS) POS.	108	1	WARNING	When ISE is provided, calibrator or control positions are set at 55 to 57. (Analysis does not start.)	Check the position for control calibration.
5511 to 5516	ACI ERROR	114	1 to 6	WARNING	Barcode IC malfunctions. 1: Unassigned 2: Unassigned 3: Sample 4: Unassigned 5: Unassigned 6: Transfer	Replace RSDIST PC board.

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
5561 to 5568	FD-WRITE?	119	1	WARNING	A hardware error has occurred in writing the routine sample measurement data.	(1) Clean the FD. (2) Replace the FD with a new one. (3) Replace the FD drive.
		119	2	WARNING	A hardware error has occurred in writing the stat sample measurement data.	
		119	3	WARNING	A hardware error has occurred in writing the control sample measurement data.	
		119	4	WARNING	A hardware error has occurred in writing the individual or cumulative alarm information.	
		119	5	WARNING	A hardware error has occurred in writing the parameter data.	
		119	6	WARNING	A hardware error has occurred in execution of FD formatting, copying into FD or FDD cleaning.	
		119	7	WARNING	A hardware error has occurred in writing the cell blank data.	
		119	8	WARNING	A hardware error has occurred in writing the routine sample test selecting information.	
5571 to 5578	FD READ?	120	1	WARNING	A hardware error has occurred in reading the routine sample measurement data.	Refer to alarm category No. 119.
		120	2	WARNING	A hardware error has occurred in reading the stat sample measurement data.	
		120	3	WARNING	A hardware error has occurred in reading the control sample measurement data.	
		120	4	WARNING	A hardware error has occurred in reading the individual or cumulative alarm information.	

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
5571 to 5578	FD READ?	120	5	WARNING	A hardware error has occurred in reading the parameter data.	Refer to alarm category No. 119.
		120	6	WARNING	A hardware error has occurred in reading the channel assignment.	
		120	7	WARNING	A hardware error has occurred in reading the cell blank data.	
		120	8	WARNING	A hardware error has occurred in reading the control parameter.	
5581	FD NOT INSERTED	121	1,2	WARNING	System disk is not set in drive 1 or data disk is not set in drive 2.	Insert the relevant disk.
5601	FD PROTECT	123	1,2	WARNING	A write-protected disk is inserted.	Unprotect the disk.
5621 to 5625	PRINTER	125	1	WARNING	Power supply is turned off or the connector is disconnected.	Check the power supply or connector.
		125	2	WARNING	Paper has run out or the printer head has risen.	Set paper or lower the printer head.
		125	4	WARNING	A hardware error has occurred on the printer.	Check the printer cable.
		125	5	WARNING	A time-out error of the printer has occurred.	(1) Check the printer cable. (2) Replace the printer.

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
5631 to 5643	SYSTEM I/F	126	1	WARNING	A reception time-out error has occurred.	(1) Check the cable of system I/F. (2) Check the contents of communication trace. (3) Check the contents of communication by line analyzer. (4) Check if a change has occurred in system parameters.
		126	2	WARNING	A transmission time-out error has occurred.	
		126	3	WARNING	A BCC error or checksum error has occurred.	
		126	4	WARNING	A parity error has occurred.	
		126	5	WARNING	A framing error has occurred.	
		126	6	WARNING	An overrun error has occurred.	
		126	7	WARNING	Frame error	
		126	8	WARNING	Text length error	
		126	9	WARNING	Function character error	
		126	10	WARNING	Sample information error	
		126	11	WARNING	Test selecting information error	
		126	12	WARNING	Comment information error	
		126	13	WARNING	Reception cannot continue up to the end code because an illegal character is received from the host. Example) A null code is received from the host.	
5681	BATH EXCHANGE FAILURE	130	1	WARNING	The start key has been pressed despite failure in incubation bath water exchange.	Do incubation bath water exchange again.
5696	PANEL I/F	140	1	WARNING	An error has occurred in LCD display module communication. ('Communication error' appears on the LCD display.)	(1) Check the communication cable of LCD. (2) Replace the LCD.
5701	REAGENT?	141	1 to 36	WARNING	Either reagent positions R1 to R3 or reagent volume alone is "0" (no specification).	Check and correct the contents of parameters R1 to R3.

(cont' d)

Alarm Control No.	Alarm	Category	Sub-code	Level	Description	Remedy
5771	CELL C. O.	145	1 to 10	WARNING	(1) More than 2 types of carry over evasion (cell) are specified for 1 test. (2) Sub-codes (1 to 10) signify the evasion types.	Check and correct the carry over evasion (cell).
5821	ISE C. O.	146	1 to 40	WARNING	R1 type is not specified for ISE test of Reagent Probe Carry Over Evasion.	Check and correct the Reagent Probe carry over evasion.

2.1.1 LCD Display Alarm

Output of Boot Error

Boot error is output to the console and the buzzer for small-size automatic analyzer (beeper is used). Output is issued unconditionally to the console whenever connected. For the small-size automatic analyzer, on the other hand, either of the destinations shown below is selected depending on system. For selection method, refer to (3).

(1) Output to Console

Output to the console always uses a log message. This is because output cannot be issued in the EAT format within a period from system start to EAT task start. Upon output, a message is sent out line by line by scroll-up method as in the logging message of VxWorks. Note that a line is fed before and after a message.
Output format is shown below. For contents of output, refer to (4).

(2) Buzzer Output for Small-Size Automatic Analyzer

The kinds of output are the same as the three kinds in the small-size immunological system. Each output has a distinctive tone at the frequency indicated below.

1) Self Test Error : 50 Hz
2) Loading Error : 250 Hz
3) OS Initial Error : 1 Hz
Sounding : Continuous

(3) Distinction in Error Message Output

For distinction in error output of small-size automatic analyzer, the configuration register of a flash memory is used.

According to the readout value of this register, output destination is distinguished as shown below. The value is set by hardware. (No setting is required in software.)

Table 2-1 Flash-Memory Configuration Register (0xf2000b)

Value	Meaning
0x01	Output to small-size automatic analyzer
Bus error	Other

(4) Contents of Output

Output for the small-size automatic analyzer comes in 3 kinds described above. So, the kinds of console output are listed below.

Table 2-2 Kinds of Console Message Output

Error	Output Message
Self-test error	1. Self Test Error (0xXX) XX: Self-test error code
Boot error	1. Rom Uncompress Error 2. F/D Boot Error (0xXXXXXXXX) 3. FROM Boot Error (0xXXXXXXXX) XXXXXXXX: Boot error code (Refer to Section 5.)
OS initial error	1. OS Initial Error (Vect = 0xXX,PC=0xXXXXXXXX) Vect = 0xXX: Vector No. PC = 0xXXXXXXXX: Program counter Note that EAT output is issued when possible.

2.2 Motor Control Alarms

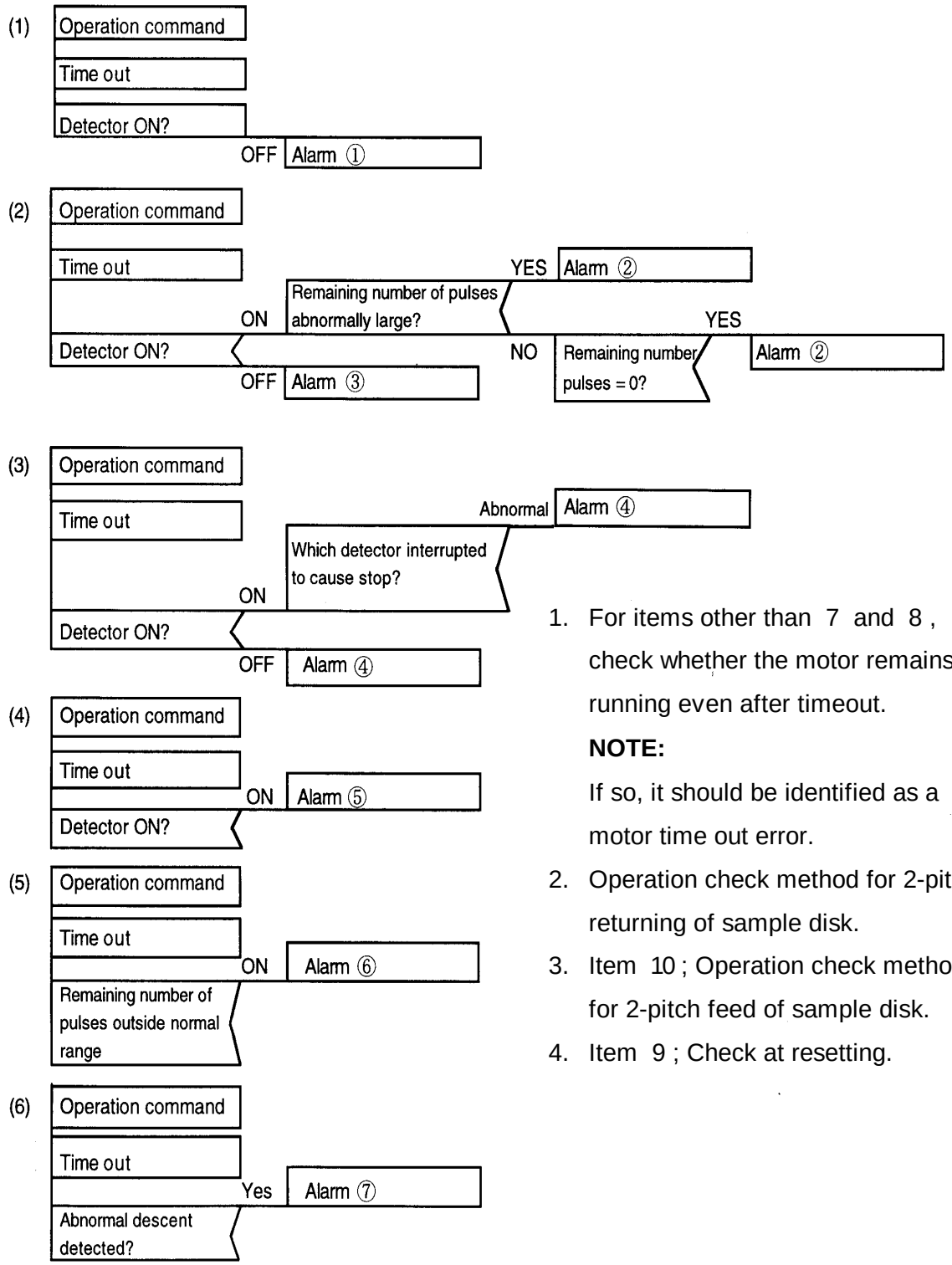
Alarm Code	Check Procedure
1 - 1	(3) - 4)
2	Unassigned
3	(4) - 5)
4	(2) - 2)·3)
	(3) - 4)
5	(2) - 2)·3)
	(3) - 4)
6	Unassigned
7	(4) - 5)
8	(8) - 9)
9	Unassigned
10	Unassigned
2 - 1	Unused
2	
3	
4	
5	
6	
7	
8	
9	
10	
3 - 1	(3) - 4)
2	(4) - 5)
3	
4	
5	
6	(OP)
7	
8	
9	
10	
4	Unused
5 - 1	(2) - 3)
	(3) - 4)
2	(2) - 2)
3	(3) - 4)
4	(2) - 2)
5	(1) - 1)
6	Unassigned
6 - 1	(3) - 4)
2	(3) - 4)
3	(5) - 6)
4	(6) - 7)
5	(4) - 5)
6	(4) - 5)
7	(7) - 8)
8	(3) - 4)

Alarm Code	Check Procedure
6 - 9	(4) - 5)
10	(5) - 6)
11	(7) - 8)
12	(6) - 7)
13	(8) - 9)
14	Unassigned
15	Unassigned
7 - 1	(2) - 3)
	(3) - 4)
	(9) - Ⓐ
	(10) - Ⓐ
2	(2) - 3)
3	(3) - 4)
4	(2) - 3)
	(10) - Ⓒ
7 - 5	(1) - 1)
	(2) - 2)
	(9) - Ⓑ
	(10) - Ⓑ
8	Unused
9	Unused
10	Unused
11	Unused
12	Unused
13	Unused
14	Unused
15 - 1	(1) - 1)
2	(4) - 5)
3	Unassigned
4	Unassigned
16 - 1	(3) - 4)
2	(6) - 7)
3	(4) - 5)
4	(70 - 8)
5	(3) - 4)
6	(4) - 5)
7	(7) - 8)
8	(8) - 9)
9	Unassigned
10	Unassigned

Alarm Code	Check Procedure
17	Unused
18 - 1	(2) - 3)
	(3) - 4)
2	(1) - 1)
	(2) - 2)
3	(2) - 3)
	(3) - 4)
19	Unused
20	Unused
21	Unused
22 - 1	(1) - 1)
2	(4) - 5)
23	Unused
24 - 1	(1) - 1)
2	(4) - 5)
25	Unused
26 - 1	(1) - 1)
2	(4) - 5)
3	
4	

(*) : OPTION

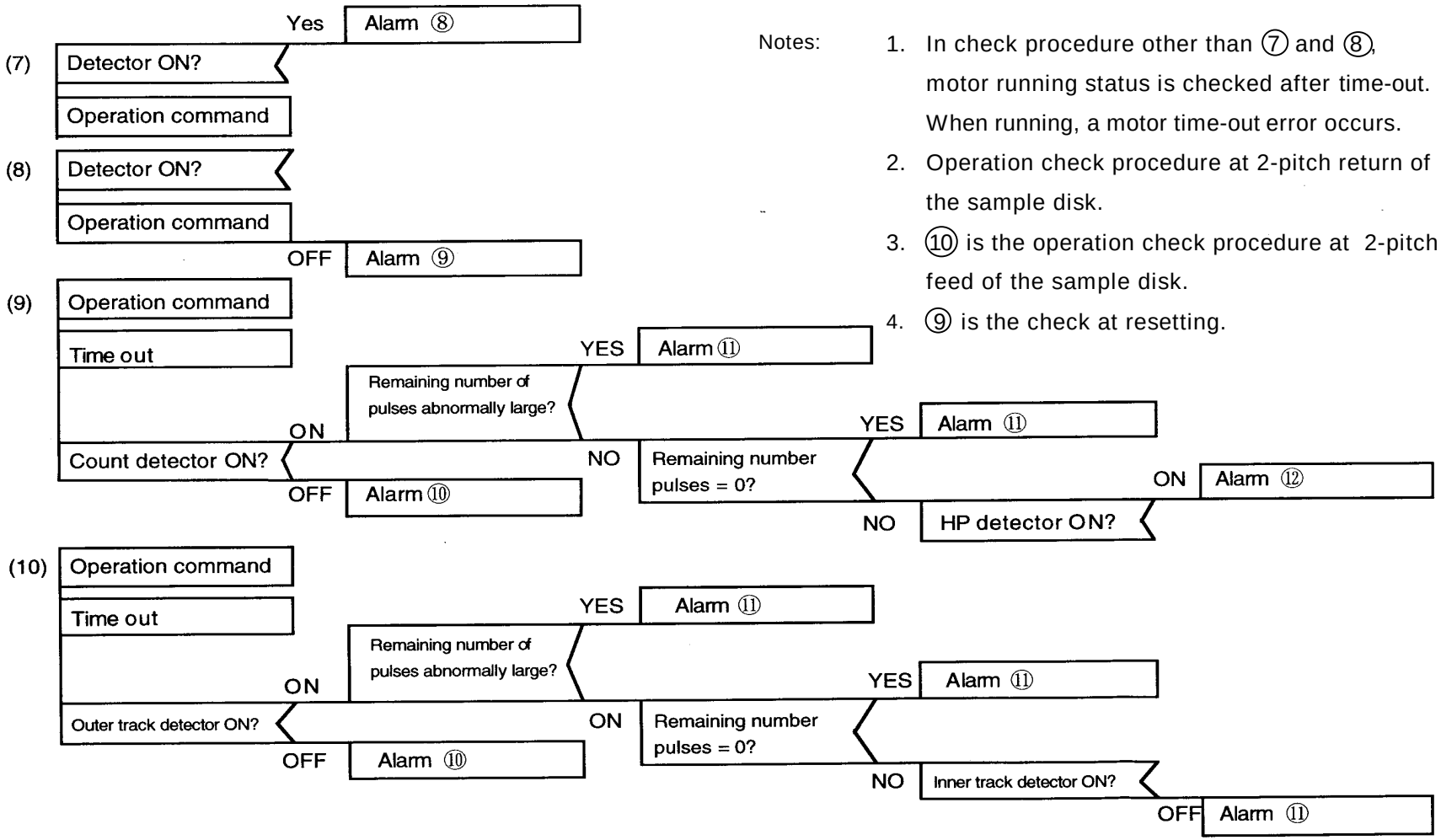
2.2.1 Operation Check Procedure at Occurrence of Alarm



1. For items other than 7 and 8 , check whether the motor remains running even after timeout.

   NOTE:

   If so, it should be identified as a motor time out error.
2. Operation check method for 2-pitch returning of sample disk.
3. Item 10 ; Operation check method for 2-pitch feed of sample disk.
4. Item 9 ; Check at resetting.



Notes:

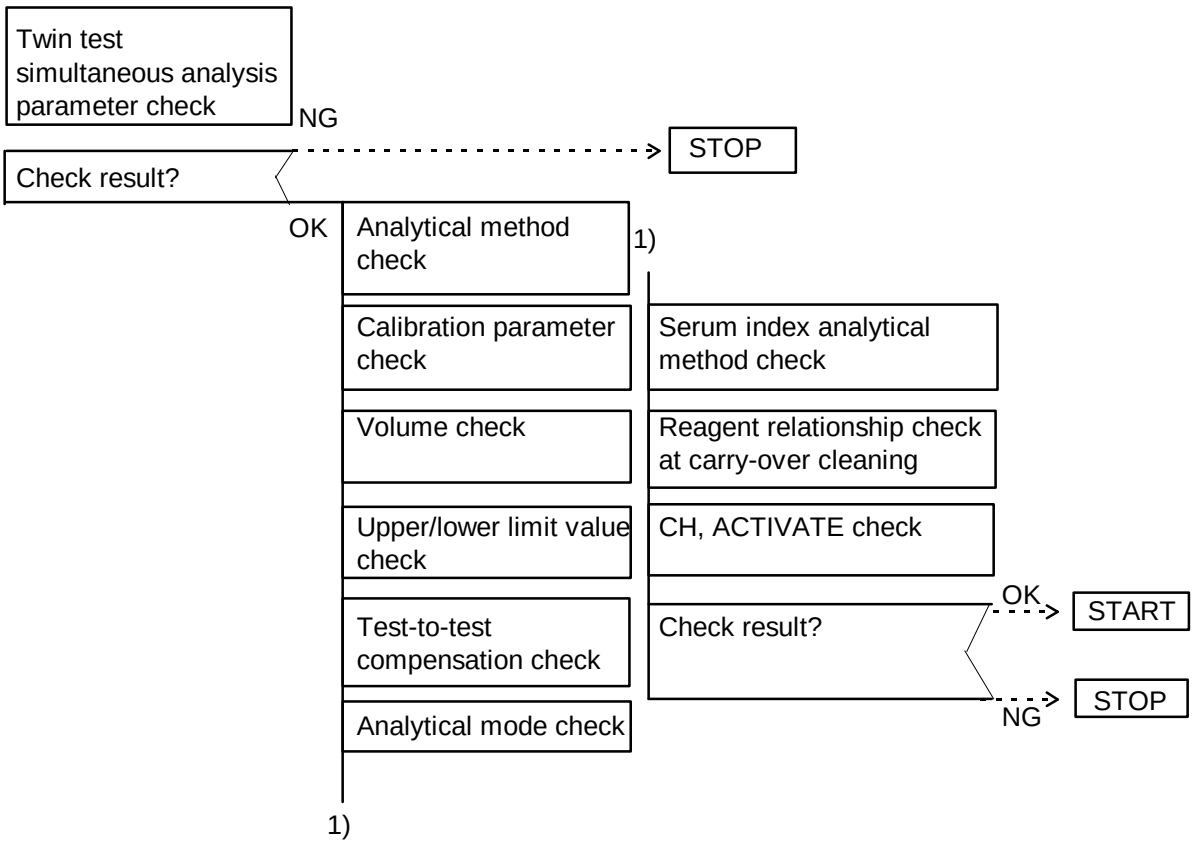
1. In check procedure other than ⑦ and ⑧, motor running status is checked after time-out. When running, a motor time-out error occurs.
2. Operation check procedure at 2-pitch return of the sample disk.
3. ⑩ is the operation check procedure at 2-pitch feed of the sample disk.
4. ⑨ is the check at resetting.

2.3 Parameter Check

Parameter check is carried out on the channel for which test is selected on the CHANNEL ASSIGNMENT screen at start of analysis.

2.3.1 Processing Flow

(1) At input of START key in STANDBY status.



2.3.2 Details of Parameter Check

No.	Designation of Check	Details of Check	Alarm		Remarks
			Display	Subdivision	
1	Check of parameters for twin test simultaneous analysis	The following are checked for measurable (level 1, Note 1) photometry tests. (1) In case of twin test simultaneous analysis, the opposite test must be specified properly. • Two tests must form a unique pair, and one of them alone must designate the other. (2) In case of other than twin test simultaneous analysis, tests must not be paired. (3) In case of twin test simultaneous analysis, two tests must be identical in all of the following parameters. • Data mode • STD POS. • STD S. VOL • Assay code • Reaction time • Sample volume • Reagent volume • Calibration type • Calibration point • Span point	TWIN TEST?	1 to 37 (CH No.)	Details of this check are given in "Details of twin test simultaneous analysis" in 2.3.3. In case of twin test simultaneous analysis, an alarm is issued if one of two tests is not registered or the manual mode is selected. **NOTE:** 1. The term 'measurable' indicates either of the following two levels. Level 1: Test registered and manual mode not selected Level 2: Same as above and reagent provided
2	Assay code check	The following are checked for measurable (level 1) photometry tests. (1) Relationship between assay code and photometric point (check of photometric point input and input range) Refer to the analytical method table in 1.1.1.	CHEM PARAM?	1 to 37 (CH No.)	

(cont'd)

No.	Designation of Check	Details of Check	Alarm		Remarks
			Display	Subdivision	
2	Assay code check	(2) Photometric points after the specified reaction time must not be set. Refer to Note 6 in "analytical method table" of 1.1.1.	CHEM PARAM?	1 to 37 (CH No.)	
3	Calibration parameter check	The following are checked for measurable (level 1) photometry tests. (1) Relationship between assay code and calibration type Refer to "relationship between calibration type and analytical method" in 2.1. (2) Entry must be made for CALIB. POINTS necessary for calibration type. Refer to "output by each calibration method and check table" in 2.7. (3) Entry must be made for STD POS. necessary for calibration. For STD specified by measured STD No. in "output by each calibration method and check table" of 2.7, it is checked whether STD POS. is input or not.	CLB. PARAM?	1 to 37 (CH No.)	**NOTES**: 1. Checked against the specification of calibration test selecting information.

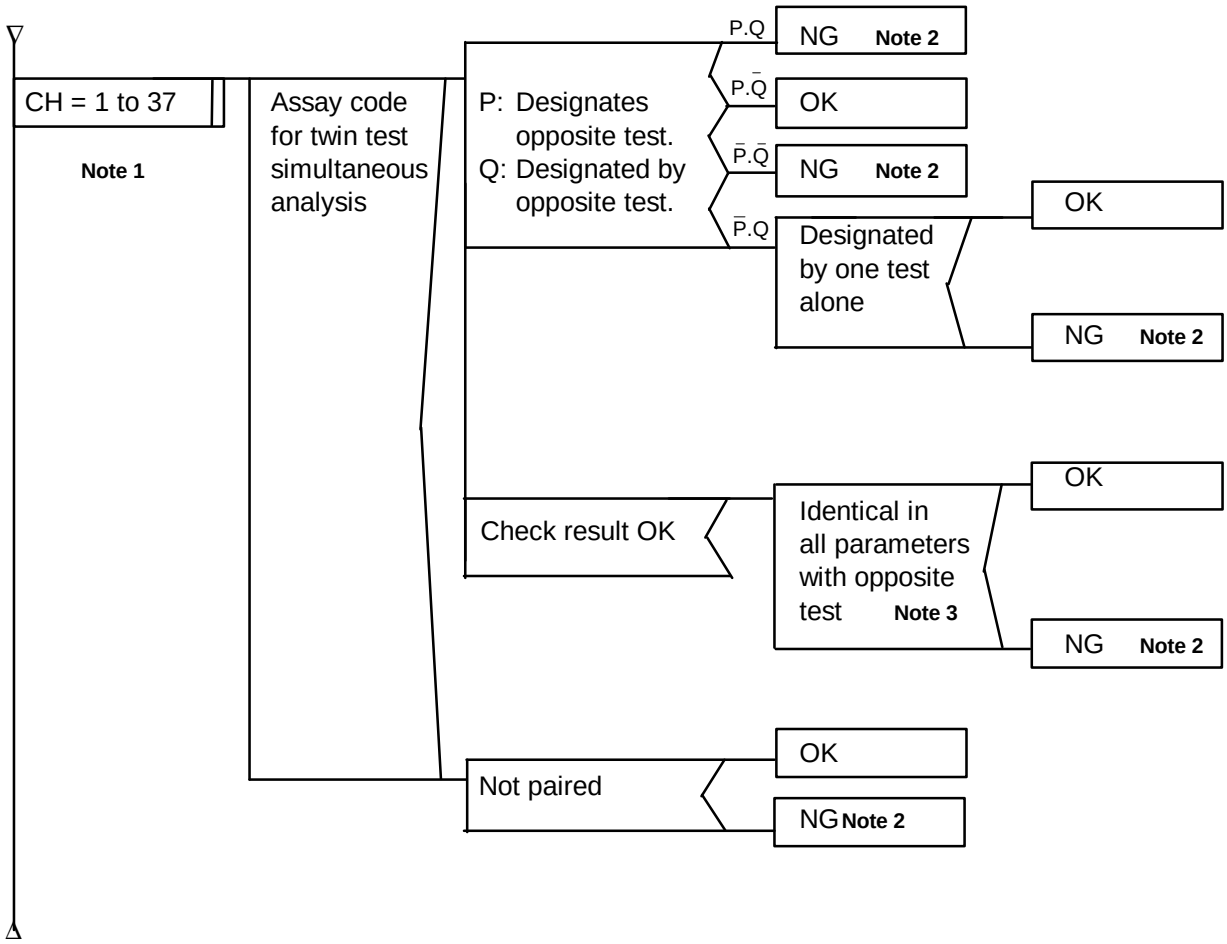
(cont'd)

No.	Designation of Check	Details of Check	Alarm		Remarks
			Display	Subdivision	
3	Calibration parameter check	(4) The input value for SPAN POINT must be normal. • When calibration type is LINEAR (2 to 6-point) or LOGIT-LOG (3P or 4P) 1) The above input value must not equal 0. 2) The above input value must not exceed that for CALIB. POINTS. (5) Relationship between calibration type and calibration method Refer to "output by each calibration method and check table" in 2.7. (Note 2) (6) STD CONC. must be set in ascending order. Check is made only for necessary STD POS. Note that isozyme STD (3) and (4) are excluded. "=" is not regarded as in ascending order. (7) When '99' is entered for POS. of STD (1), CONC. must be 0.	CLB. PARAM?	1 to 37 (CH No.)	**NOTES:** 2. Checked against the specification of calibration test selecting information.
4	Volume check	The following are checked for measurable photometry tests. (1) The total liquid volume up to the final photometric point must be 500 µL or less. (2) At least one of R1 to R3 volumes must not be 0. (3) The reagent volume having a timing behind the reaction time is not 0. (4) The minimum liquid volume must be at least 250 µL.	VOLUME ?	1 to 37 (CH No.)	When reagent volume = 0, the relevant reagent is not used.

(cont'd)

No.	Designation of Check	Details of Check	Alarm		Remarks
			Display	Subdivision	
5	Test-to-test compensa-tion check	For formula No. where compensated test is measurable: (1) The compensation test must be measurable. In addition, when the compensation test is already registered as a compensated test in any preceding formula No., the check result for the formula No. must be OK. (2) The compensated test must be on the right side of the formula. (3) When the compensated test is a photometry test, no ISE test must be registered for the compensation test.	CMP. TEST?	44 to 51 (FORMULA No.)	This check is not performed in case of ORIGINAL ABS.
6	Serum index analytical method check	(1) The assay code for tests for serum index measurement must be RATE-A. This check is made only when the tests are measurable. (2) In the RATE-A test with serum indexes, no R2 must be specified when sample blank correction is carried out.	S. INDEXES?	1 to 37 (CH No.)	
7	Cell carry over	(1) More than 2 types of carry over evasion (cell) are specified for 1 test. (2) Sub-codes (1 to 10) signify the evasion types.	CELL. C. O.	1 to 10	Check and correct the carry over evasion (cell).
8	ISE carry over	R1 type is not specified for ISE test of Reagent Probe Carry Over Evasion.	ISE C. O.	1 to 40	Check and correct the Reagent Probe carry over evasion.

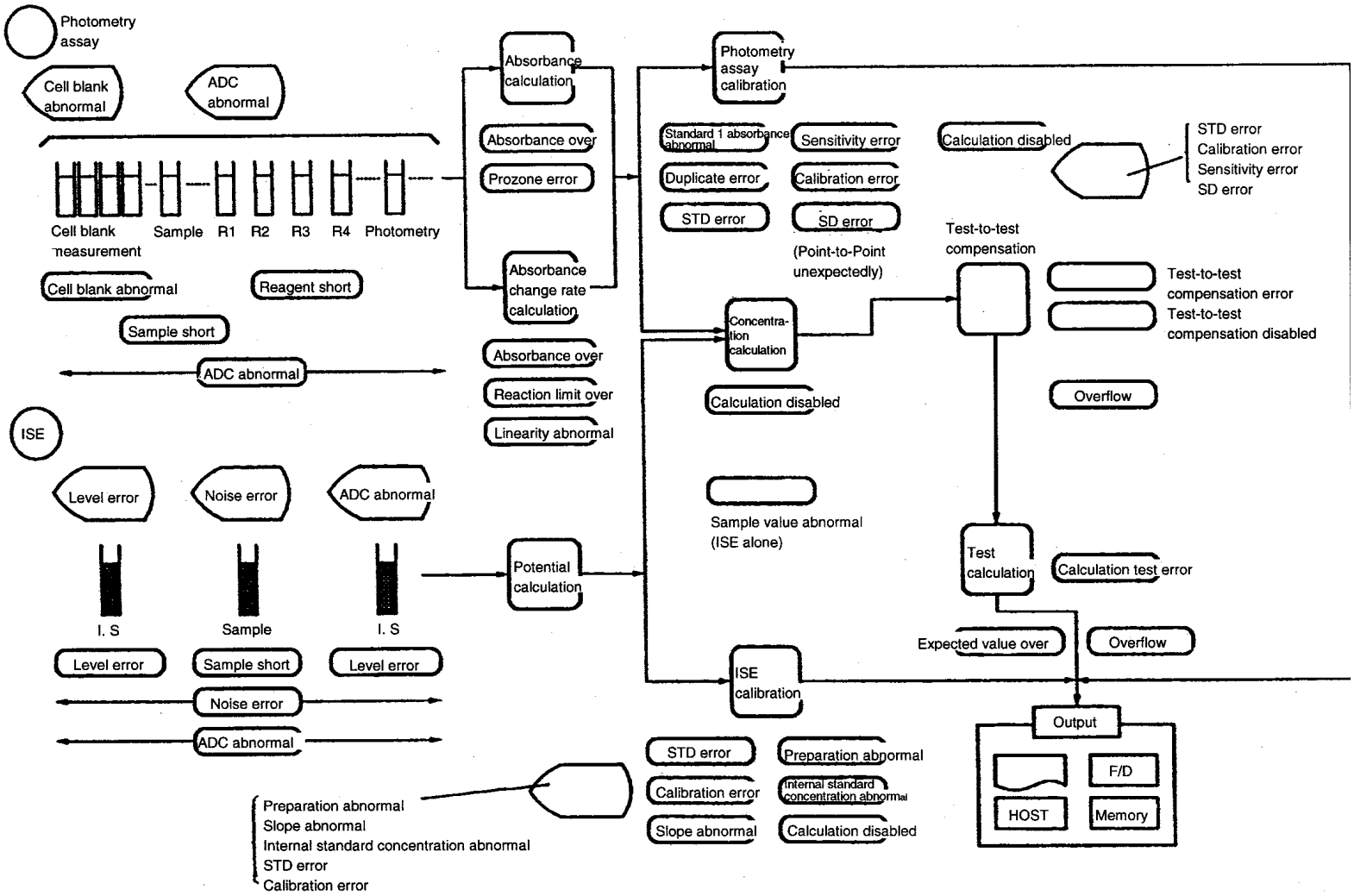
2.3.3 Details of Twin Test Simultaneous Analysis



NOTES:
1. Unmeasurable channels are excluded.
   However, in twin test simultaneous analysis, alarm occurs when either one of the two tests is unmeasurable.
2. Alarm is registered with a channel No. assigned for subdivision.
3. Refer to "Details of Parameter Check" in 2.3.2.

2.4 Data Alarm

2.4.1 Data Alarm Registration Flow



2.4.2 Data Alarm Code List

No.	Data Alarm	Output String			Photometry Assay				ISE				Remarks
		PRINTER	CRT	S.I/F	Routine	Stat	Control	STD	Routine	Stat	Control	STD	
1	ADC abnormal	ADC?	A	A	O	O	O	O	O	O	O	O	
2	Cell blank abnormal	CELL?	Q	Q	O	O	O	O					
3	Sample short	SAMPLE	V	V	O	O	O	O	O	O	O	O	• Data may become blank space.
4	Reagent short	REAGN	T	T	O	O	O	O					
5	Absorbance over	ABS?	Z	Z	O	O	O	O					• Data may become blank space.
6	Prozone error	*****P	P	P	O	O	O	O					
7	Reaction limit over at all points	LIMT0	I	I	O	O	O	O					• Prozone value is output to the printer only when the monitor is in the real time mode. *****indicates a prozone value (5-digit).
8	Reaction limit over except 1 point	LIMT1	J	J	O	O	O	O					
9	Reaction limit over except 2 or 3 points	LIMT2	K	K	O	O	O	O					
10	Linearity abnormal at 9 points or more	LIM.	W	W	O	O	O	O					
11	Linearity abnormal at 8 points or less	LIM.8	F	F				O					
12	Standard 1 absorbance abnormal	S1ABS?		H				O					
13	Duplicate error	DUP		U				O				O	
14	STD error	STD?		S				O				O	
15	Sensitivity error	SENS		Y				O					
16	Calibration error	CALIB		B					O	O	O	O	
17	SD error	SD?		G					O	O	O	O	
18	Noise error	NOISE	N	N								O	
19	Level error	LEVEL	L	L					O	O	O	O	
20	Slope abnormal	SLOPE?		E					O	O	O		
21	Internal standard concentration abnormal	I.STD		D	O	O	O		O	O	O		
22	Sample value abnormal	R.OVER	&	&	O	O	O		O	O	O		
23	Test-to-test compensation error	CMP.T	C	C	O	O	O		O	O	O		
24	Test-to-test compensation disabled	CMP.T!	M	M	O	O	O	O	O	O	O	O	• Data becomes blank space.
25	Calculation test error	CALC?	%	%	O	O	O		O	O	O		• Data becomes blank space
26	Overflow	OVER	0	0									• Data becomes blank space.
27	Calculation disabled	???	X	X									• May concur with other alarm.
28	Expected value high limit over	H											• May concur with other alarm.
29	Expected value low limit over	L											
30	Electrode preparation	PREP.		R								O	
31	SD absorbance over	>AMAX	>	>	O	O	O						• Data becomes blank space. BM only

NOTES: 1. If any data caused multiple data alarms, the alarm registered first will be output.
2. When [Specify] is entered for measured value space parameter in the start condition screen.

2.4.3 Data Alarm Codes

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	ADC abnormal	ADC?	A	The ADC value of main or sub wavelength (only main wavelength in single wavelength photometry) is zero.	• Perform measurement again. • Turn off the power switch, and then turn it on.
	Cell blank abnormal	CELL?	Q	(Photometry assay only) Two or more of the four passed cell blank values to be used for CELL BLANK are abnormal. **Note:** Abnormal when the difference from the reference value (value measured with cell blank function on the maintenance screen) is ± 0.1 Abs or more.	• Perform cell blank measurement once a week or after replacement of the light source lamp or reaction cuvette. • Confirm the adequate volume of HITERGENT. After taking a proper measure, exchange incubation bath water once. • Rinse or replace the reaction cuvette and perform cell blank measurement. • After washing the light transmitting window in the incubation bath, perform cell blank measurement.
	Sample short	SAMPL	V	Before sample aspiration, the presence/absence of sample is checked and it is found that the sample is absent.	• Inject the sample in a volume of expected consumption + 50 µL or more into a standard cup. • Insert the lead wire.
	Reagent short	REAGN	T	Before reagent aspiration, the presence/absence of reagent is checked and it is found that the reagent is absent.	• Prepare and set reagent newly. • Insert the lead wire.

(cont'd)

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	Absorbance over	ABS?	Z	(Photometry assay) The absorbance value to be used for calculation after cell blank correction exceeds 3.3 Abs. The absorbance is checked for every wavelength.	• In 1-point & rate, rate-A or rate-B assay, check is not carried out for the interval to determine the absorbance change rate if an ascending reaction setting is made for that interval. • Dilute the sample or reduce its volume, and then perform measurement again. • Set the sample correctly. • Prepare the reagent again.
	Prozone error	*****P ('*****' indicates a prozone value.)	P	(Photometry assay only) In 1-point or 2-point assay with prozone check, the prozone error is indicated if 'prozone' is detected. Prozone check is performed by comparing the prozone value (hereafter referred to as PC value) obtained from calculation mentioned below with the prozone limit value preset on the chemistry parameter screen. For the lower prozone limit, the prozone error is indicated if the PC value is smaller. For the upper prozone limit, the error is indicated if the PC value is larger. In the event of prozone error, the relevant PC value is also printed out (only in real-time monitor printing mode).	• Prozone check values are printed out only in the real-time monitor printing mode. • Delution or retest with decreased volume is performed. • For no-check, enter ' -32000' (lower limit) at " Prozone limit value" on the parameter setting menu screen 1.

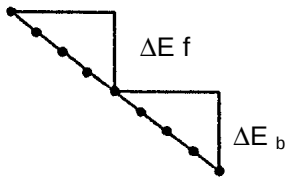
(cont'd)

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	Prozone error	*****P ('*****' indicates a prozone value)	P	Shown below are the expressions for calculation of the PC value. Assuming that the preset photometric points are P1 and P2 and the difference in absorbance between two wavelengths at photometric point P is E: (1) In 1-point assay PC value = $Ep_2, p_{2\text{-}1} - k\ Ep_2, p_{1\text{-}1}$ k: Liquid volume correction factor Note that k = 1 when $1 \leq P1, P2 \leq 5$ or $6 \leq P1, P2 \leq 16$ or $17 \leq P1, P2 \leq 33$ or $34 \leq P1, P2 \leq 73$. Prozone check is not carried out if P2 = 0. (2) In 2-point assay PC value = $\frac{Ep_2 - Ep_3}{P2' - P3} \Big/ \frac{Ep_4 - Ep_3}{P4 - P3}$ Note that prozone check is not carried out if P3 = 0 or $\lvert Ep_4 - Ep_3 \rvert \leq 100 \times 10^{-4}$ Abs. When P2' = 0, P2 is used. In either case of (1) and (2), prozone check is not made for STD (1) measurement.	

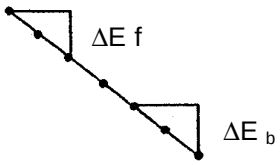
(cont'd)

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	Reaction limit over All points NG Only one point OK Only two or three points OK	LIMT 0 LIMT 1 LIMT 2	I J K	(Photometry assay only) In 2-point rate, 1-point & rate, rate-A or rate-B assay, the main wavelength absorbance at the photometric point to be used for calculation exceeds the reaction limit value (value obtained after automatic correction of input reaction limit value). The error condition varies depending on the number of photometric points within the reaction limit range as shown below. (1) The reaction limit is exceeded at all points in the input photometric range. (2) The reaction limit is exceeded at the second and subsequent points excluding the first point. (3) The reaction limit is exceeded at the third and subsequent points excluding the first two points, or at the fourth and subsequent points excluding the first three points.	• This alarm is issued whenever the input photometric range values l and m for calculation of the absorbance change rate do not satisfy l + 2 < m. (Caution) In 2-point rate assay, check is made using not the input photometric range values l and m alone but all photometric points between l and m. • Dilute the sample or reduce its volume, and then perform measurement again. • Prepare the reagent again. • Check for leakage or clogging of the reagent pipettor. • Input correct values on parameter registration menu.

(cont'd)

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	Linearity abnormal Number of photometric points in reaction limit level range ≥ 9	LIN.	W	(Photometry assay only) In 1-point & rate, rate-A or rate-B assay, the absorbance at each photometric point to be used for calculation of the absorbance change rate does not satisfy the following relational requirement. $\frac{\lvert \Delta E_1 - \Delta E_b \rvert}{\lvert \Delta E \rvert} \times 100$ ≤ Linearity limit value Where, ΔE: Absorbance change rate determined from absorbance at each photometric point in reaction limit level range by least squares method ΔE_1: Absorbance change rate in first half ΔE_b: Absorbance change rate in second half Assuming that the number of photometric points in the reaction limit level range is N, ΔE_1, ΔE_b and linearity limit value can be represented as shown below. (1) When N ≥ 9 Linearity limit value LIMIT 8  	• Make sure the sample does not contain dust, etc. • Dilute the sample and measure it again. • If the stirring motor does not rotate normally, report to the servicemen. • The light source lamp should not be used beyond 750 hours. • Replace the light source lamp and perform cell blank measurement.
	4 ≤ Number of photometric points in reaction limit level range ≤ 8	LIN. 8	F		LIMIT8 and LIN.LIMIT values are both fixed. (Unit: %, value: LIN.LIMIT = 10, LIMIT8 = 30)

(cont'd)

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	4 ≤ Number of photometric points in reaction limit level range ≤ 8	LIN. 8	F	(2) When 4 ≤ N ≤ 8 Linearity limit value LIN. LIMIT  Note that linearity check is not carried out in the following cases. • The number of photometric points in the reaction limit level range is three or less. • |ΔE|≤ 60 (× 10e - 4ABS/min) • |ΔEf - ΔE_b|≤ 60 (× 10e - 4ABS/min)	
	Standard 1 absorbance abnormal	S1ABS?	H	(Photometry assay) (Note 1) In calibration, the mean value of two measured absorbance values of STD (1) is not within the specified standard 1 absorbance range (input value). Value is absorbance with End-point Assay, in the case of late assay, is main wave O length first absorbance.	• Prepare the standard properly. • Set the standard properly. • Unless check is desired, input a value within - 32000 to 32000 for "standard 1 absorbance range" on the parameter registration menu 1 screen.
	Duplicate error	DUP	U	(Photometry assay) In calibration, this error is indicated if the difference in absorbance (or absorbance change rate) between the first and second measurements of STD (i) is larger than the DUPLICATE LIMIT (input value). (i = 1 to N: N indicates the number of standards.)	• Replace the seal piece of pipettor. • Check fastening of joints. • Unless check is desired, input 32000 for "duplicate limit absorbance" on the parameter registration menu 1 screen.

(cont'd)

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	STD error	STD?	S	(Photometry assay) (1) In calibration, any one of the following alarms is encountered with the measured STD absorbances: ADC abnormal, cell blank abnormal, sample short, reagent short, absorbance over, reaction limit over, linearity abnormal, prozone error, duplicate error, calculation disabled and standard 1 absorbance abnormal. (2) In calibration, calculation is disabled before completion. (3) In non-linear calibration (EXPONENTIAL and Logit-Log5P), an extreme value is found. (4) After execution of non-linear calibration (SPLINE), the result of extreme value/inflection point check is NG. (ISE) Calibration is invalid. (Any one of the following alarms is encountered: ADC abnormal, sample short, calculation disabled, noise error and level error.)	• The parameters on the screen and FD are not updated.

(cont'd)

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	Sensitivity error	SENS	Y	(Photometry assay) Sensitivity check is carried out only for linear (2 to 6-point), non-linear or isozyme P calibration. This error is indicated if the difference in mean absorbance between STD (1) and STD (N) is smaller than SENSITIVITY LIMIT (input value). N: Linear (2-point)/ isozyme P calibration ..... 2 Non-linear/linear (3 to 6-point) calibration ..... 2 to 6 (input value for SPAN POINT) Note, however, that N = 2 when CALIB. POINTS = 2 in non-linear LOGIT-LOG (3P)/(4P) calibration. For the mean absorbance of STD (1) in span calibration, the following data is used. Linear ..... Previous S1 ABS Non-linear ..... Previously updated mean absorbance Sensitivity check is not made in R.B. calibration.	• The parameters on the screen and FD are not updated. • Set the standard solutions and reagent properly. • Prepare the standard solutions newly. • Check the sample syringe for leakage, clogging, etc. • Unless check is desired, input 0 for "sensitivity limit absorbance" on the parameter registration menu.
	SD error	SD?	G	(Photometry assay) This error is indicated upon completion of non-linear calibration or if the SD value in linear (multi-point) calibration is larger than SD LIMIT (input value).	• Set in correct concentration series. • Replace the seal piece of pipettor. • Check fastening of joints. • Unless check is desired, input 999.9 for "SD limit absorbance" on the parameter registration menu.

(cont'd)

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	Calibration error	CALIB	B	(Photometry assay) In linear (2 to 6-point) or isozyme P calibration, the calibration condition is checked at calculation of parameter K. This error is indicated if there is a difference of ±20% or more between the current and previous K values. (ISE) The calibration concentration or slope level for display does not satisfy the following expression. |Previous value - current value| ~~(Previous value + current value)/2~~ ×100% > COMPENSATE LIMIT	• Same as in SENS • Pay attention to storage method and the time period of placement on the sample disk. • If the result is satisfactory, operation can be continued. After measurement, record parameters on the maintenance menu to store the K value.
	Noise error	NOISE	N	(ISE) This error is indicated if the difference between the maximum and minimum potentials is within the following range at three of the five measuring points for each test (on internal standard or sample). Na : 0.7mV < |FIV(2) - FIV(4)| K : 1.0mV < |FIV(2) - FIV(4)| Cl : 0.8mV < |FIV(2) - FIV(4)|	• Set reagent and perform ISE priming (with internal standard solution and diluent) once. • Make sure O-ring is fitted to each electrode and its holder and it is not fitted doubly. After reattaching, perform ISE priming (with reference electrode solution). • Replace the tube and perform ISE priming (with reference electrode solution) once. • Clean the waste solution drain path. • Clean the syringe and plunger and replace the seal piece.

(cont'd)

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	Level error	LEVEL	L	(ISE) This error is indicated if the mean potential is outside the following range at three of the five measuring points for each test (on internal standard). Na : -90.0mV ≤ EAV ≤ -10mV ⇒OK K : -90.0mV ≤ EAV ≤ -10mV ⇒OK Cl : 100.0mV ≤ EAV ≤ 180.0mV ⇒OK	• Set reagent and perform ISE priming (with reference electrode solution) twice. • Replace the electrode and perform ISE priming (with reference electrode solution) once. • Retighten the nipple. Or after replacing the rubber packing, perform ISE priming (with reference electrode solution) once. • Confirm the proper combination of tube and reagent. • Plug in the cord properly.
	Slope abnormal	SLOPE?	E	(ISE) (1) The slope level for display is within the following range. Na, K : SLOPE < 45.0mV, Cl : SLOPE > -35.0mV (2) Electrode response is degraded. (Carry-over rate is as shown below.) Na : 0.232 < A K : 0.160 < A Cl : 0.490 < A	• Replace the electrode. • Remove the probe and correct clogging. • Set properly. • Confirm the proper combination of tube and reagent.
	Electrode preparation	PREP.	R	Upon calibration, the slope value is within the following range. Na, K : 45.0mV ≤ Slope value ≤ 49.9mV or 68.1mV ≤ Slope value Cl : -39.9mV ≤ Slope value ≤ -35.0mV or -68.1mV ≤ Slope value	• Make sure that the standard solution and reagent are set properly. • Make sure that the standard solution is free from concentration or deterioration. • Make sure that the electrodes (Na, K, Cl) are within their guaranteed life.

(cont'd)

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	Internal standard concentration abnormal	I. STD	D	(ISE) The internal standard concentration (C(IS)) is within the following range. Na : C(IS) < 120.0mEq/L or 160.0mEq/L < C(IS) K : C(IS) < 3.0mEq/L or 7.0mEq/L < C(IS) CL : C(IS) < 80.0mEq/L or 120.0mEq/L < C(IS)	• Confirm monthly flow path washing. • Replace the diluent and internal standard solution.
	Calculation test error	CALC?	%	Any data alarm other than shown below is indicated for the test to be used for calculation. Calculation disabled, test-to-test compensation disabled, expected value over	• Check the data alarm name and take a proper measure.
	Overflow	OVER	O	Concentration value (or activity value) cannot be output within the specified range of digit count.	• The data is left blank. • Prepare appropriate standard solution.
	Calculation disabled	???	X	• In process of calculation, the denominator becomes zero. • An overflow occurs in logarithmic or exponential calculation. • In isozyme Q-channel concentration calculation, the data alarm of 'calculation disabled' is indicated for the isozyme P-channel data or the isozyme P channel is not measured. • Calculation for a calculation test has been attempted with the data having a data blanking alarm.	• The data is left blank. • Determine the cause of failure to color development such as improper kind of standard solution, wrong set position and clogging of sample probe. • Dilute the sample or reduce its volume and perform analysis again.
	Expected value over	 L H	 – –	The test result is outside the expected value range (outside mean value ± 2SD in case of a control sample). • Smaller than the lower limit value • Larger than the upper limit value	• This alarm is not indicated for serum index. • Correct setting on the parameter registration menu 1 screen.

(cont'd)

No.	Data Alarm	Printer	S. I/F	Description	Remedy
	Sample value abnormal	R. OVER	&	(ISE) The sample concentration (C(S)) is within the following range. Na : C(S) < 10.0mEq/L or C(S) > 250.0mEq/L K : C(S) < 1.0mEq/L or C(S) > 100.0mEq/L Cl : C(S) < 10.0mEq/L or C(S) < 250.0mEq/L	• Dilute the sample and analyze it again. • Direct measurement is impossible. Utilize standard addition method, etc. • Remove the probe and correct clogging.
	Test-to-test compensation error	CMP.T	C	(1) In test-to-test compensation calculation, any data alarm other than shown below is indicated for the compensation data. (2) In isozyme Q-channel concentration calculation, any data alarm other than shown below is indicated for the isozyme P-channel concentration. Calculation disabled, test-to-test compensation disabled, overflow, random error, systematic error, QC error, expected value over	• Check the channel data used for test-to-test compensation.
	Test-to-test compensation disabled	CMP.T!	M	(1) In process of calculation for test-to-test compensation, the denominator becomes zero. (2) The test to be used for test-to-test compensation is not measured. (3) Any test to be used for test-to-test compensation has the data alarm of 'calculation disabled' or 'test-to-test compensation disabled.' (4) Any compensation test has the data alarm which leaves the data blank.	• The data is left blank. • Make sure masking is not specified for the test to be used for compensation. • Check the calculation formula on the parameter registration menu 3 screen.
	SD absorbance over	>AMAX	>	At standard concentration of "∞", absorbance of sample or absorbance change rate is over or the same compared with presumptive absorbance or absorbance change rate.	————

2.4.4 ISE Data Alarms

Alarm on ISE data processing has 2 kinds shown below; calibration alarm and data alarm.

(1) Calibration Alarm

Priority	Alarm	Printout	CRT	S. I/F	ISE Processing		Alarm Output on Operation Monitor Screen	Remarks
					N.E.C.R	STD		
1	STD error	STD?	−	S	×	O	O	In calibration measurement, this alarm is set at any of the data alarms in (2) (excluding data alarms 6 to 9).
2	Slope abnormal	SLOPE?	−	E	×	O	O	
3	Electrode preparation	PREP	−	R	×	O	O	
4	Internal standard concentration abnormal	I. STD	−	D	×	O	O	
5	Calibration error	CALIB	−	B	×	O	O	

< Key >
N : Routine sample measurement
E : Stat sample measurement
C : Control sample measurement
STD : Calibration measurement

(2) Data Alarm

Priority	Alarm	Printout	CRT	S. I/F	ISE Processing		Alarm Output on Operation Monitor Screen	Remarks	ISE Check Data Alarm
					N.E.C.R	STD			
1	ADC abnormal	ADC?	A	A	O	O	O	Registration is made on the operation monitor in ADC task.	O
2	Sample short	SAMPLE	V	V	O	O	×	At occurrence of this alarm, the 'calculation disabled' alarm is also set (for making output data blank).	×
3	Noise error	NOISE	N	N	O	O	O		O
4	Level error	LEVEL	L	L	O	O	O		O
5	Sample value abnormal	R.OVER	&	&	O	×	×		×
6	Calculation disabled	???	×	×	O	O	×		×
7	Test-to-test compensation disabled	CMP.T!	M	M	O	×	×	Check is not performed in ISE data processing.	×
8	Test-to-test compensation error	CMP.T	C	C	O	×	×		×
9	Overflow	OVER	O	O	O	×	×		O

(3) Registration of Data Alarm "sample short"

Measured Sample	Alarm Issued in Sampling (Note 1)		Data Output (Note 2)	Data Alarm (Note 3)
	1st Time	2nd Time		
Other than STD (1)	A	–	×	O
	B	–	O	O
	C	–	O	×
STD (1)	A	–	×	O
	B	–	O	O
	C	–	O	×
	Water discharge	–	O	×

NOTES: 1. A: Pre-detection is not made.
B: Pre-detection is made and at least either one of the following is encountered.
(i) The number of remaining pulses is zero.
(ii) Abnormal fall detection is activated within ±2 mm of the cup bottom level recognized in probe adjustment.
C: Other than A and B
(Pre-detection refers to liquid level detection till a time point just before sample aspiration since start of probe fall.)
2. O: Output
×: Space
3. O: Issued
×: Not issued

2.4.5 Alarm Check Method

(1) Photometry Assay Calibration Check

(a) SD check of approximate expression

When SD in the difference between the automatically generated calibration curve and the measured absorbance value in non-linear calibration is larger than "SD limit absorbance," comment SD? is printed. SD value is printed under the test name in the result of calibration. Unless check is desired, input 999.9.

(b) Duplication check

In measurement of reagent blank and standard solution, comment DUP is printed when the difference in absorbance between two measurements is larger than "duplicate limit absorbance." Unless check is desired, input 32000.

(c) Sensitivity check

When the difference in absorbance between reagent blank (STD1) and standard solution (having the maximum concentration if there are multiple standard solutions), comment SENS is printed. Unless check is desired, input 0.

(d) Standard solution 1 absorbance check

When the absorbance of reagent blank (standard solution 1) exceeds "standard 1 absorbance range," comment S1 ABS is printed. In an end-point assay test, the absorbance value on the left side of calibration result printout is checked and that on the right side is checked in a rate-assay test. Unless check is desired, input -32000 to 32000.

(2) Reaction Limit Level Check

When concentration or enzyme activity is abnormally high in a rate assay test, correct data is unobtainable because the substrate or coenzyme in reagent is consumed completely. Therefore, the upper or lower reaction limit absorbance is set for check . Check is made on the absorbance at the main wavelength alone.

< Relationship between Alarm Name and Photometric Point >

When 4 points or more over the specified photometric range are within the reaction limit, measurement is carried out normally. In case no point, 1 point or 2 points are within the reaction limit, a reference value is obtained depending on an absorbance change between the first two points. In case 3 points are within the reaction limit (with comment LIMT2), the value obtained depending on an absorbance change among the first three points is printed as a reference value.

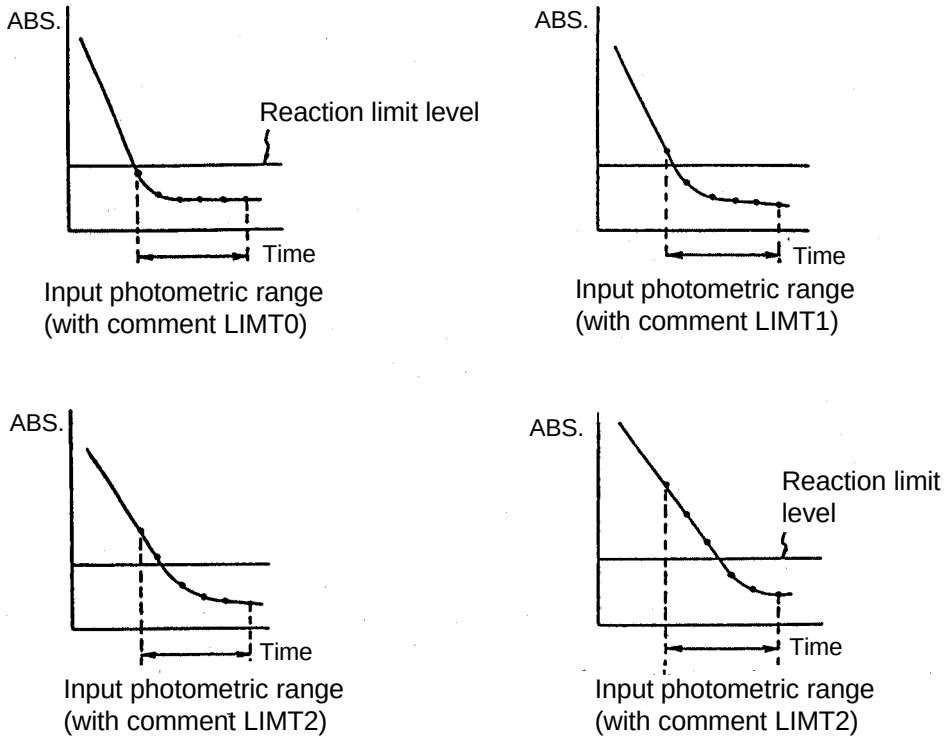


Fig. 2-1 Reaction Limit Level Check

< Automatic Correction of Reaction Limit Level >

The instrument corrects the input reaction limit level by adding an absorbance value due to sample turbidity, etc.

Reaction limit level = Input reaction limit absorbance value + (L_1 - L_B)

L_1 : Sample absorbance at photometric point 1

L_B : Reagent blank absorbance at photometric point 1

When $L_1 - L_B \leq 0$, automatic calibration will not be performed.

(a) Electrolyte compensable range check.

When the ratio of change in calibrator concentration or slope value from the previous one is larger than the input value, comment CALIB is printed. Unless check is desired, input 200%.

(b) Calibration check

When calibration factor K has changed by 20% or more from the previous value, comment CALIB is printed (check value is fixed at 20%).

(c) STD check

If any of the following alarms occurs on calibration data, comment STD? is printed.

- ADC abnormal (ADC?)
- Cell blank abnormal (CELL?)
- Sample short (SAMPL)
- Reagent short (REAGN)
- Absorbance over (ABS!)
- Prozone error (xxxxxP)
- Reaction limit over (LIMT0, 1, 2)
- Reaction linearity abnormal (LIN. or LIN.8)
- Duplicate error (DUP)
- Standard 1 absorbance abnormal (S1ABS?)
- Calculation disabled (???)

(d) Measure to be taken on printout of comment

When comment STD? or SENS is indicated, calibration curve will not be updated. Therefore, recalibration is necessary. In case of CALIB or SD!, sample measurement is allowed after making sure the result of calibration is normal. In this case, however, the result of calibration will not be saved automatically onto the floppy disk. Before turning off power supply, parameters should be recorded on the maintenance screen.

Table 2-1 Handling of Calibration Result with Comment

Printed Comment	Calibration Result (display on screen)	Alarm Name on Operation Monitor Screen	Automatic Saving onto Floppy Disk
STD?	Not updated (previous result remains)	Calibration curve generation disabled (code 70-1 to 49)	The reagent blank (S1ABS) and calibration factor (K) of the relevant test are not saved automatically onto floppy disk.
SENS	Not updated (previous result remains)	Standard solution sensitivity abnormal (code 73-1 to46)	
CALIB	Updated (to new result)	Calibration abnormal (code 70-1 to 49)	
SD !	Updated (to new result)	Calibration SD abnormal (code 72-1 to 46)	

(3) Reaction Linearity Check

In a rate assay test, the linearity in absorbance change is checked.
Check value varies with the number of points (N) in photometric range.

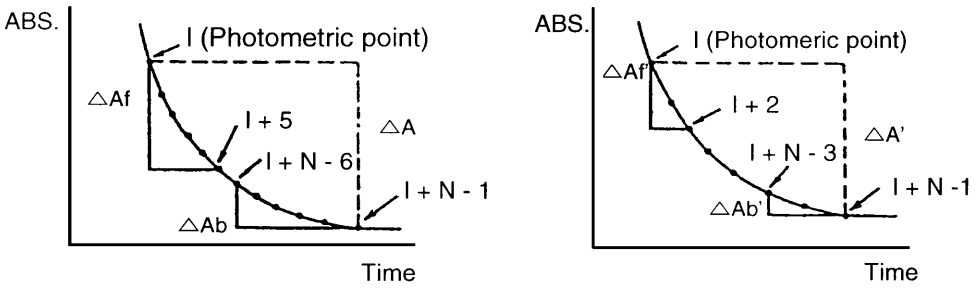


Fig. 2-2 Reaction Linearity Check

< When $N \geq 9$ >

The difference in absorbance change quantity between the first-half 6 points (5 sections) and the latter-half 6 points is obtained and then divided with the overall absorbance change quantity. When the result of this calculation exceeds the limit in linearity check, comment LIN. is printed together with the result of measurement.

$$\frac{|\Delta Af - \Delta Ab|}{|\Delta A|} \times 100 > \text{Linearity limit value.....LIN.}$$

< When $4 \leq N \leq 8$ >

The difference in absorbance change quantity between the first-half 3 points (2 sections) and the latter-half 3 points is obtained and then divided with the overall absorbance change quantity. When the result of this calculation exceeds the limit in linearity check, comment LIN.8 is printed together with the result of measurement.

$$\frac{\left|\Delta Af^{9} - \Delta Ab^{9}\right|}{\left|\Delta A^{9}\right|} \times 100 > \text{Linearity limit value.....LIN.8}$$

- ΔAf, ΔAb and ΔA in the above formula are all converted into absorbance change in a minute by the least squares method.
- In the following cases, reaction linearity is not checked.
  a) The number of photometric points (N) within the reaction limit is 3 or less ("reaction limit over" will occur).
  b) Absorbance change in a minute is 60×10^{-4} Abs or less, or $|\Delta Af - \Delta Ab|$ is equal to or smaller than 60×10^{-4}.

(4) Prozone Check

In immunological reaction, the absorbance of calibration curve falls at high concentrations so that correct data is unobtainable (this is called "zone phenomenon or prozone effect"). Therefore, prozone check is performed by the two methods below and a data comment is indicated when required.

< Antigen Readdition Method >

In 1-point assay, a small amount (approx. 50 µL) of sample containing antigen is readded for the second reagent (R2 to R4) to check the change in absorbance before and after addition (the dashed line in Fig. 2-3 indicates that absorbance falls due to excessive antigen).

< Reaction Rate Ratio Method >

In 2-point assay, check is performed according to the ratio of the initial reaction rate after addition of antiserum to the mean reaction rate.

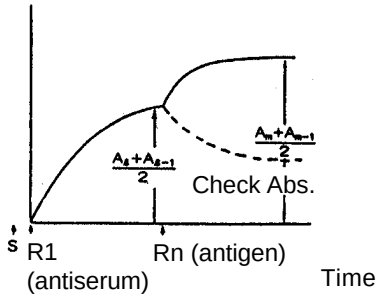


Fig. 2-3 Antigen Readdition Method

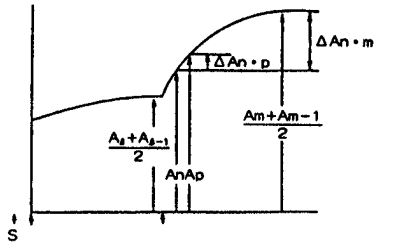


Fig. 2-4 Reaction Rate Ratio Method

	Antigen Readdition Method (1-point assay)	Reaction Rate Ratio Method (2-point assay)
Absorbance for concentration calculation	$A_x = \frac{A_l + A_{l-1}}{2}$	$A_x = \frac{A_m + A_{m-1}}{2} - k\frac{A_l + A_{l-1}}{2}$
Prozone check value (PC value)	$PC = \frac{A_m + A_{m-1}}{2} - k\frac{A_l + A_{l-1}}{2}$	$PC = \frac{(A_m - A_n)/(m-n)}{(A_p - A_n)/(p-n)} \times 100$

< Judgment >

In case of 'limit value - above,' comment xxxP (xxx indicates PC value) is printed when PC value is larger than the limit value. In case of 'limit value - below,' the comment is printed when PC value is smaller than the limit value.

- Prozone check will not be performed in the following cases.
  (1) In STD (1) measurement (2) $|Ap - Am| < 100 \times 10^{-4}$ Abs

(5) ISE Calibration Alarm Check

Alarm Name	Alarm Check Method (alarm setting condition)
Standard error	Calibration is invalid. (Any of the following alarms has occurred; ADC abnormal, sample short, calculation disabled, noise error and level error.)
Slope abnormal	(1) The slope for display is within the following range. Na, K : Slope < 45.0 mV Cl : Slope > -35.0 mV (2) Electrode response is degraded (carry-over ratio is as given below). Na : 0.232 < A K : 0.160 < A Cl : 0.490 < A
ISE prepare	(1) The slope for display is within the following range. Na, K : 45.0 mV ≤ Slope ≤ 49.9 mV or 68.1 mV ≤ Slope Cl : -39.9 mV ≤ Slope ≤ -35.0 mV or -68.1 mV ≥ Slope (2) Electrode response is degraded (carry-over ratio is as given below). Na : 0.154 < A K : 0.107 < A Cl : 0.330 < A
Internal standard concentration abnormal	The concentration of internal standard solution (C(IS)) is within the following range. Na : C (IS) < 120.0 mEq/L or 160.0 mEq/L < C (IS) K : C (IS) < 3.0 mEq/L or 7.0 mEq/L < C (IS) Cl : C (IS) < 80.0 mEq/L or 120.0 mEq/L < C (IS)
Calibration abnormal	On each of the calibrator concentration and slope for display, the previous and current values are compared and the result exceeds the COMPENSATE LIMIT value. $\frac{\lvert \text{Previous value - Current value} \rvert}{\text{(Previous value + Current value)/2}} \times 100\ (\%) > \text{COMPENSATE Limit}$

(6) ISE Data Alarm Check

Alarm Name	Alarm Check Method
ADC abnormal	The result of ADC is abnormal. (Checked in ADC task)
Sample short	Sample volume is inadequate. (Checked in control task)
Noise error	This alarm is issued when a difference between maximum and minimum potential values at three out of five measurement points in each test is within the following range (on internal standard and sample). Na : 0.7 mV $\leq$ |FIV (2) - FIV (4)| K : 1.0 mV $\leq$ |FIV (2) - FIV (4)| Cl : 0.8 mV $\leq$ |FIV (2) - FIV (4)|
Level error	This alarm is issued when a difference between maximum and minimum potential values at three out of five measurement points in each test is within the following range (on internal standard). Na : -90.0 mV $\leq$ EAV $\leq$ -10 mV $\Rightarrow$OK K : -90.0 mV $\leq$ EAV $\leq$ -10 mV $\Rightarrow$OK Cl : 100.0 mV $\leq$ EAV $\leq$ 180.0 mV $\Rightarrow$OK
Sample value abnormal	The sample concentration (C(S)) is within the following range. Na : C (S) < 10 mEq/L or C (S) > 250 mEq/L K : C (S) < 1 mEq/L or C (S) > 100 mEq/L Cl : C (S) < 10 mEq/L or C (S) > 250 mEq/L
Calculated disabled	Due to zero division, log-X, etc.

2.4.6 Check and Set Alarm of Each Data

(1) Calibration

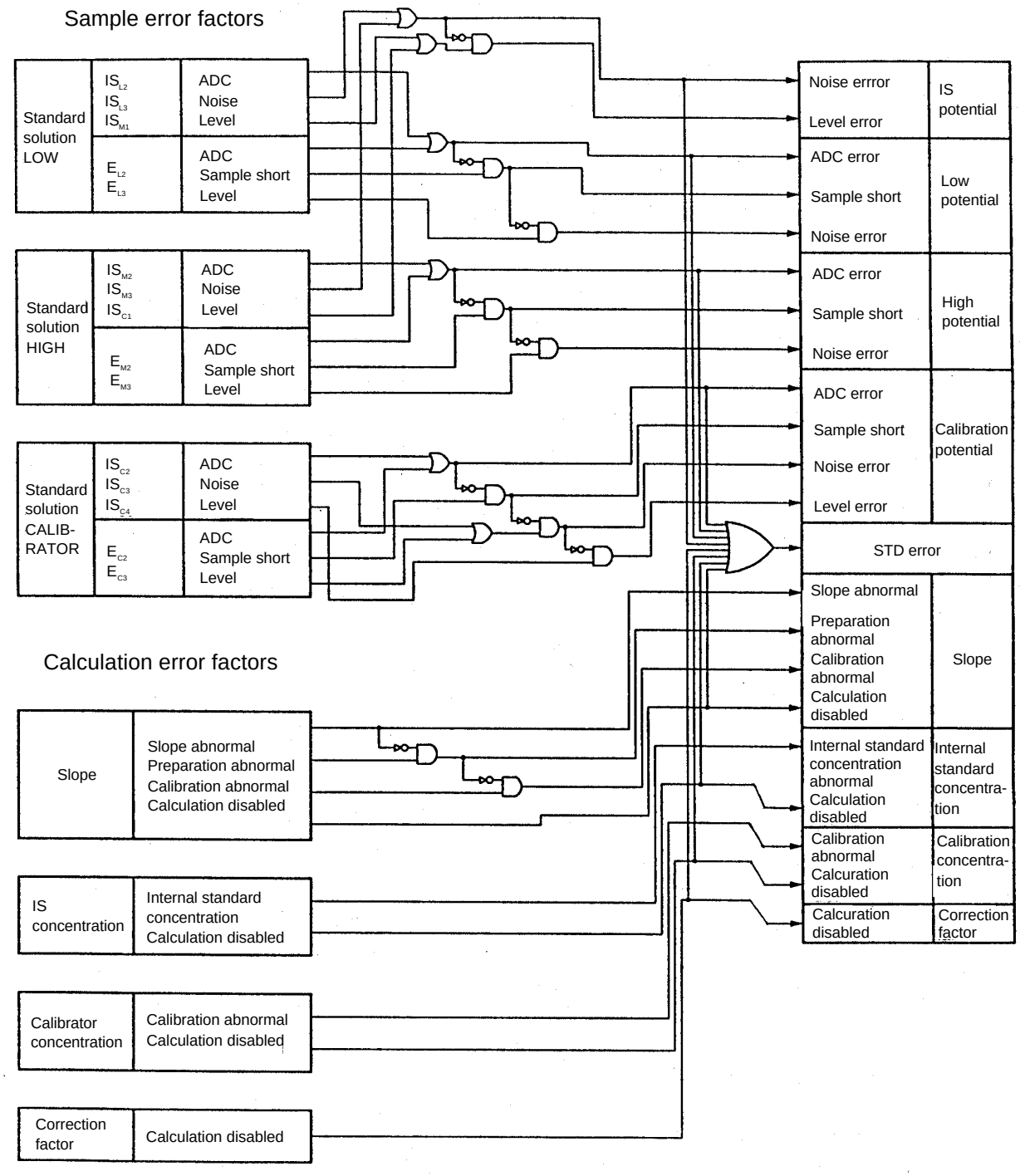
Data Kind \ Priority		1	2	3	4	5	6
Potential of internal standard solution	Na K Cl	Noise error	Level error				
Low potential of standard solution	Na K Cl	ADC abnormal	Sample short	Noise error			
High potential of standard solution	Na K Cl	↑	↑	↑			
Calibrator potential	Na K Cl	↑	↑	↑	Level error		
Slope value (for display)	Na K Cl	Slope abnormal	Preparation abnormal	Calibration abnormal	Calculation disabled		
Concentration of internal standard solution	Na K Cl	Internal standard concentra-tion abnormal	Calculation disabled				
Calibrator concentration	Na K Cl	Calibration abnormal	Calculation disabled				
Correction factor	Na K Cl	Calculatio n disabled					

(2) Routine Sample Measurement (1st), Stat Sample Measurement (1st) and Control Sample Measurement

Data Kind \ Priority		1	2	3	4	5	6
Sample concentration	Na K Cl	ADC abnormal	Sample short	Noise error	Level error	Sample value abnormal	Calculatio n disabled

If multiple data alarms concur, the one with the highest priority will be indicated.

2.4.7 Details of Data and Alarm Outputs Resulting from Calibration



2.4.8 Output Check List for Each Photometry Assay CALIB. METHOD

CALIB. TYPE		CALIB. METHOD (Note 1)	Measured STD No. (Note 2)						Sensitivity Check		Availability of Calibration Error Check	Calibration Output Parameter (Note 4)										STD No. Output on CALIBRATION TRACE Screen		Availability of SD Error Check	Remarks
			1	2	3	4	5	6	Availability	Check STD No. (Note 3)		SI ABS	K	A	B	C	SD	a(1)	b(1)	c(1)	d(1)	□	(Note 5) ×		
Linear	1 point	R. B.	○						×		×	○										1		×	
	2 points	R. B.	○						×		×	○										1		×	
		SPAN		○					○	STD(1), STD(2)	○		○										2	×	
		2pt.	○	○					○		○	○	○									1	2	×	
	3 to 6 points	R. B.	○						×		×	○										1		×	
		SPAN		△	△	△	△	△	○	STD(1), STD(M)	○		○										M	×	
		2pt.	○	△	△	△	△	△	○		○	○	○									1	M	×	
		FULL	○	○	○	○	○	○	○		○	○	○				○					1	M	○	
Isozyme	P channel (4 points)	R. B.	○						×	STD(1), STD(2)	×	○										1		×	
		FULL	○	○	○	○			○		○	○	○									1	2	×	
	Q channel (3 points)	R. B.	○						×		×	○	○									1		×	
		FULL	○		○	○			×		×	○	○	○	○							1		×	
Non-linear	LOGIT-LOG 3 parameters (2 points)	R. B.	○						×	STD(1), STD(2)	×	○										1		×	
		SPAN		○					○		×	○	○										2	×	
		2pt.	○	○					○		×	○	○									1	2	×	
	LOGIT-LOG 3 parameters (3 to 6 points)	R. B.	○						×	STD(1), STD(M)	×	○										1		×	
		SPAN		△	△	△	△	△	○		×	○	○										M	×	
		2pt.	○	△	△	△	△	△	○		×	○	○									1	M	×	
		FULL	○	○	○	○	○	○	○		×	○	○	○			○					1	M	○	
	LOGIT-LOG 4 parameters (2 points)	R. B.	○						×	STD(1), STD(2)	×	○										1		×	
		SPAN		○					○		×	○	○										2	×	
		2pt.	○	○					○		×	○	○									1	2	×	
	LOGIT-LOG 4 parameters (3 to 6 points)	R. B.	○						×	STD(1), STD(M)	×	○										1		×	
		SPAN		△	△	△	△	△	○		×	○	○										M	×	
		2pt.	○	△	△	△	△	△	○		×	○	○									1	M	×	
		FULL	○	○	○	○	○	○	○		×	○	○	○	○		○					1	M	○	
	LOGIT-LOG 5 parameters (3 to 6 points)	R. B.	○						×	STD(1), STD(M)	×	○										1		×	
		FULL	○	○	○	○	○	○	○		×	○	○	○	○	○	○					1	N	○	
	EXPONENTIAL (3 to 6 points)	R. B.	○						×	STD(1), STD(M)	×	○										1		×	
		FULL	○	○	○	○	○	○	○		×	○	○	○	○	○	○					1	N	○	
	SPLINE (3 to 6 points)	R. B.	○						×	STD(1), STD(M)	×	○						○				1		×	
		FULL	○	○	○	○	○	○	○		×	○					○	○	○	○	○	1	N	○	

NOTES: 1. R.B. : 1-point calibration (with STD (1) alone)
SPAN : 1-point calibration (with STD (M) alone)
2pt. : 2-point calibration
FULL : Full calibration

2. Δ : Any one (Necessary STD No. depends on the input value for SPAN POINT on the CHEMISTRY PARAMETERS screen.)
3. M : SPAN POINT input value (2 to 6) on CHEMISTRY PARAMETERS screen
4. a (l), b (l), c (l) and d (l) are saved onto HD. They will not be output to screen and logging sheet.
5. N : CALIB. POINTS input value (3 to 6) on CHEMISTRY PARAMETERS screen

(1) List of Calibration Output Media

Output Medium / Output Data	CRT (screen name)	PRT	S. I/F
Calibration curve parameters (S1ABS, K, A, B, C)	CALIBRATION LIST	×	×
SD value	×	CALIBRATION MONITOR	O
Serum index blank	CALIBRATION LIST	×	×
Blank level	×	×	×
Absorbance or absorbance change rate	×	CALIBRATION MONITOR	O
Initial or final observance	×	CALIBRATION MONITOR	O

NOTE: In plotting of measured absorbance values, the currently measured STD alone is taken.

(2) Relationship between Alarm and Output in Calibration

Data Alarm Name	Updating of Screen Parameter	Screen Display of Alarm	Remarks
S1ABS error	No	No	
DUPLICATE error	No	No	
STD error	No	Yes	
SENSITIVE error	No	Yes	
CALIB error	Yes	Yes	
SD error	Yes	Yes	
No alarm	Yes	No	

NOTE: For CALIB and SD errors, "∗" is output on logging for discrimination.

2.5 Retry Code Table

Code	Description	Allowable Retry Count	Remarks
1	Alarm fuse blown	1/50 ms	
2	12 V for lamp	1/4.5 sec	Check is not made when lamp is turned off (during initialization, water exchange or sleep).
3	15 V for CPU rack	1/50 ms	
4	-15 V for CPU rack	1/50 ms	
14	Liquid in vacuum tank	1/4.5 sec	
15	Vacuum pressure abnormal	1/4.5 sec	Check is not made within 10 sec after vacuum pump turns on.
16	Waste solution tank	1/4.5 sec	
17	Incubation bath water inadequate	100/4.5 sec	Checked in the following statuses; standby, operation, sampling stop.
18	Distilled water short	1) 10/6 sec	Water supply
		2) 50/6 sec	Warning
		3) 150/6 sec	STOP
19	Distilled water sensor abnormal	1/6 sec	Check is not made during initialization, water exchange or wake-up.
31	GPCNT1	10	Only at power-on
32	GPCNT2	10	Only at power-on
33	GPCNT3	10	Only at power-on
34	GPCNT4	10	Only at power-on
35	GPCNT5	10	Only at power-on
36	GPCNT6	10	Only at power-on
37	GPCNT7	10	Only at power-on
38	GPCNT8	10	Only at power-on
46	GMCNT1	10	Only at power-on
47	GMCNT2	10	Only at power-on
48	GMCNT3	10	Only at power-on
49			
50	ADC controller	1	Only at power-on
71	Checksum error detected in operation unit	1	
72	Checksum error detected in analyzing unit	1	
102			
103			
104			
105			
106			
107			

2.5.1 Logging Program List

No.	Function	Output Method	Processing	Printout Stop by Stop Key
1	Monitor printout	Real time printout: Specify "print" on the start condition menu screen. Printout is made when the specified values in all tests for one sample are calculated during operation. Batch printout: Specify sample number on the data monitor screen.	Real time and batch	O (In batch mode alone)
2	Calibration result printout	Printout is made when "calibration" is selected on the start condition menu screen and the result of calibration is output.	Real time	×
3	Remaining reagent volume printout	Specify "remaining reagent volume printout" on the start condition menu screen.	Batch	×
4	Cell blank printout	Specify "cell blank" on the maintenance screen.	Batch	O
5	Reproducibility check printout	Specify "reproducibility check" on the maintenance screen.	Batch	O
6	Cumulative mechanism information printout	Specify "cumulative mechanism information" on the mechanism check menu screen.	Batch	×
7	Parameter printout	Specify "parameter" on the maintenance screen.	Batch	O
8	Program check printout	Specify "program check" on the mechanism check menu screen.	Batch	×
9	ISE check printout	Specify "ISE" check on the mechanism check menu screen.	Real time	×
10	Photometer check printout	Specify "photometer check" on the maintenance screen.	Batch	O (Note 1)
11	Alarm trace printout (DAILY)	Specify "alarm trace information" on the mechanism check menu screen.	Batch	O
12	Alarm trace printout (CUMULATIVE)	Specify "alarm trace information" on the mechanism check menu screen.	Batch	O
13	Original Abs. printout	Printout is made when "original Abs." is specified on the system parameter screen and operation is executed.	Real time	× (Note 2)
14	Communication trace printout	Specify "communication trace printout" on the mechanism check menu screen.	Batch	O
15	Work sheet printout	Specify "work sheet printout" on the TS registration screen of routine analysis.	Batch	O
16	Barcode Reader check	Specify "Barcode Reader" check on the mechanism check menu screen	Real time	×

NOTES: 1. The stop key is invalid during printout.
2. The stop key need be pressed to stop analysis.

(1) Initialization of Printer

Effected when power supply is turned on or there is a printer alarm at start of printing one processing.

(2) Paper Feed

- At end of printout
  At the end of each printout (in batch mode of No. 1 and in Nos. 3 to 15), paper is fed by 3 lines.
  (Paper is also fed when printout is stopped by stop key input.)

(3) Page Length

Page length is not determined.

(4) Printing Performance

4 lines/sec (80 characters/sec), 2.54 cm/6 lines, paper feed in pitches of 4.23 mm/line (1/6 inch)

(5) Printing System

Numerals are right-justified with space at leading positions unless there is a comment.

(6) Printout with No Blank Space

- Channel number is not registered in keyed-in information.
- Measured data is unavailable.

(7) For Leaving Blank Space

Overflow has occurred at the location where measured data is to be printed.

2.6 Daily Alarm Trace

(1) Outline

The alarm and retry data from power-on to present time point are printed when "daily" in "alarm trace data" is specified on the mechanism check menu screen.

(2) Details of Printout

(a) Title
The title "Daily Alarm Trace," date and time are printed.
The printing order of year, month and day depends on the date printout order specification.

(b) Time (24-hour base)
Time when alarm and retry data has been saved onto FD.

(c) Instrument status
Numerical value representing the instrument status. For details, refer to Table 2-2.

(d) Occurrence count
Indicates how many times the same alarm/retry data as that in a single cycle has occurred successively (in the number of cycles within 1 to 999).

(e) Identification character
'A' is printed out for alarm data, and 'R' for retry data. Printout is not made when there is no data in each case.

(f) Alarm data
The alarm data is printed out in the order of main alarm code (3-digit integer), sub alarm code (3-digit integer) and time of occurrence up to 10 kinds. If 10 kinds are exceeded, excess ones are not stored. However, they are saved as cumulative data.
Time of occurrence: Time on the basis of operation cycle (000 to 179) when the alarm has occurred (in 100 msec).

(g) Retry data
The retry data is printed out in the order of retry code (3-digit integer), retry count (3-digit integer) and time of occurrence up to 10 kinds. If 10 kinds are exceeded, excess ones are not stored. However, they are saved as cumulative data.

(h) Key operation data
The key operation data is printed out in the order of key operation code (3-digit integer), key operation count (3-digit integer) and time of key operation (3-digit integer). Printout is made only once.

Table 2-2 Instrument Status Code Table

Blank row is the unassigned one.

Code	Instrument Status	Code	Instrument Status	Code	Instrument Status
1	Initialization	23		45	Incubation bath water exchange
2	Standby (including parameter check)	24		46	Resetting
3	Preparation for operation	25		47	Probe position adjustment (sample probe rotation)
4	Operation	26		48	Probe position adjustment (sample probe up/down)
5	Sampling stop	27		49	Probe position adjustment (reagent probe rotation)
6		28		50	Probe position adjustment (reagent probe up/down)
7		29	T/M stop	51	Probe position adjustment (stirrer)
8	Stop	30	Emergency stop	52	Mechanism check
9		31		53	Barcode Reader check
10		32		54	ISE check (internal standard electromotive force measurement)
11		33	Rinsing (cell)	55	
12		34	Rinsing (ISE)	56	
13		35	Rinsing (all)	57	
14		36		58	
15		37	Photometer check	59	
16		38	ISE priming (IS)	60	
17		39		61	
18		40		62	Routine sampling stop (restart unallowable)
19		41	ISE priming (REF)	63	
20		42		64	
21		43	Cell blank	65	Mechanism resetting during operation
22		44		66	

(3) Printout System

(a) Data is printed out in the sequential order starting from the newest data.
(b) When the alarm/retry data in a single cycle does not reach 10 kinds, it is printed out closely with no blank line left.
(c) When there is no alarm data or retry data, its title alone is printed.

(4) Notes

(a) Printout can be stopped in steps of cycle by stop key input.
(b) Up to 500-cycle data starting from the oldest one is saved onto FD. However, if the same data has recurred in consecutive cycles, storage is made as one-cycle data.
(c) In case of FD error, processing is terminated with the title alone printed.

2.6.1 Cumulative Alarm Trace

(1) Outline

The alarm data and retry data saved in the FD are printed when "cumulative" in "alarm trace data" is specified on the mechanism check menu screen.

(2) Details of Printout

(a) Title
The title "Cumul. Alarm Trace," date and time are printed.
The printing order of year, month and day depends on the date printout order specification.
(b) Final alarm occurrence date/time
The printing order of occurrence date depends on the date printout order specification. Time printout is fixed to 24-hour base.
(c) Identification character
'A' is printed out for alarm data, 'R' for retry data and 'K' for key operation. Printout is not made when there is no data in each case.
(d) Alarm data
The alarms, which have occurred in a day, are printed out in the order of main alarm code (3-digit integer), sub alarm code (3-digit integer) and occurrence count (3-digit integer) up to 20 kinds.
(Occurrence count: The cumulative number of identical alarms which have occurred in a day)
(e) Retry data
The retries, which have occurred in a day, are printed out in the order of retry code (3-digit integer) and retry count (3-digit integer) up to 20 kinds.

(f) Key operation data
The key operation data is printed out in the order of key operation code (3-digit integer), key operation count (3-digit integer) and time of key operation (3-digit integer). Printout is made up to 16 kinds.

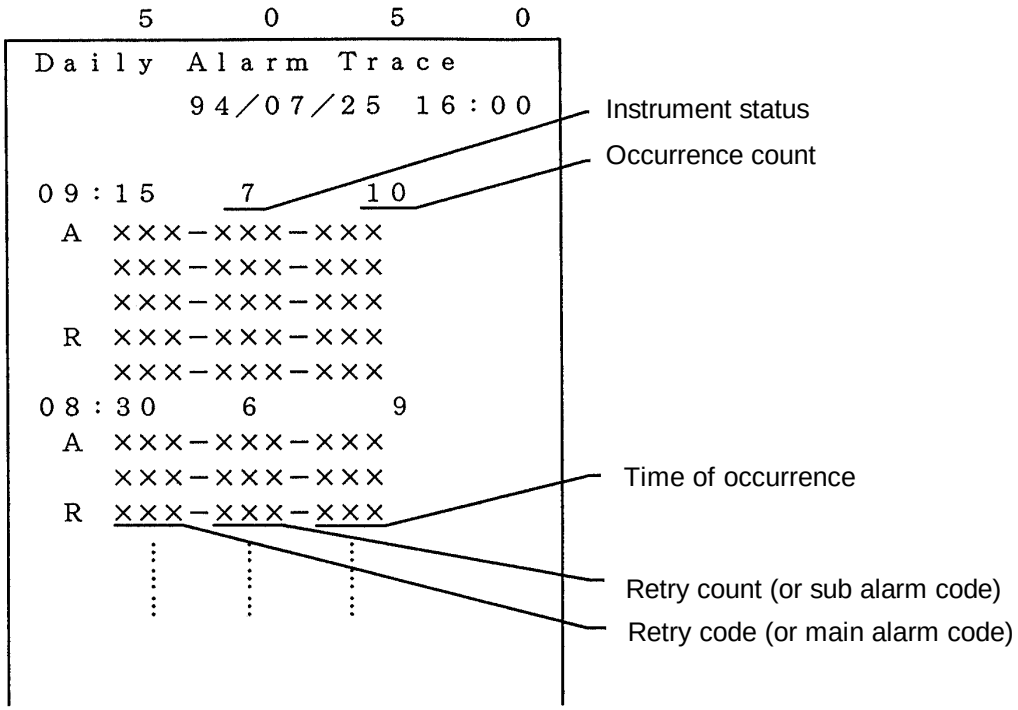
(3) Printout System

(a) Data is printed out in the sequential order starting from the newest data.
(b) When the alarm/retry data in a day does not reach 20 kinds, it is printed out closely with no blank line left.
(c) When there is no alarm data or retry data, its title alone is printed.

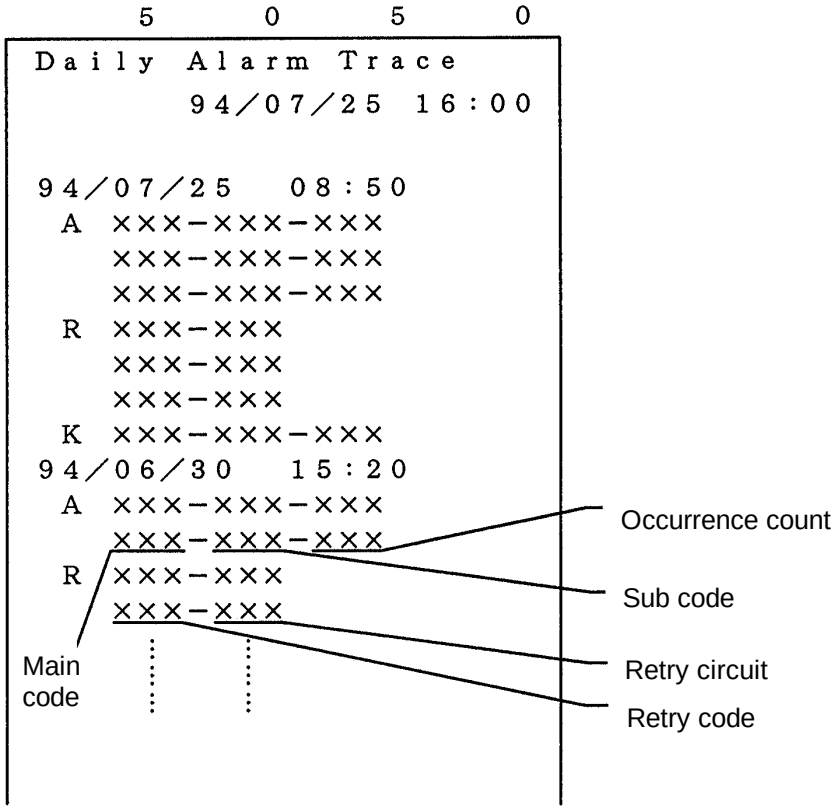
(4) Notes

(a) Printout can be stopped in steps of day by stop key input.
(b) The data obtained from power-on to power-off is taken as daily data and the data for up to 256 days is saved onto FD starting from the newest data. In case of continuous energization, however, a day's data is automatically closed when the day changes and subsequent data is treated as for the following day.
(c) In case of FD error, processing is terminated with the title alone printed.

Alarm Trace Printout (DAILY)



Alarm Trace Printout (CUMULATIVE)



2.6.2 Parameter Code List

```
No.<ISE>
 1. Low Conc.
 2. High Conc.
 3. Calibrator Conc.
 4. Ref. Volume
 5. Expect.Value(L)
 6. Expect.Value(H)
 7. Instr.Fact.(a)
 8. Instr.Fact.(b)
 9. Comp.Limit
10. C Value
11. Key Setting
No.<Calculated Test>
 1. Test Name
 2. Formula
 3. Test A
 4. Test B
 5. Factor a
 6. Factor b
 7. Expect.Value(L)
 8. Expect.Value(H)
No.<Comp. Test>
 1. Test Name
 2. Formula
 3. Test A
 4. Test B
 5. Factor a
 6. Factor b
```

```
Parameter_
      95/11/30 17:42

No.<Chemistry>
 1. Test Name
 2. Assay Code(Mthd)
 3. Assay Code(Test)
 4. Reaction Time
 5. Assay Point 1
 6. Assay Point 2
 7. Assay Point 3
 8. Assay Point 4
 9. Wave Leng.(SUB)
10. Wave Leng.(MAIN)
11. Sample Volume
12. R1 Volume
13. R1 Pos.
14. R1 Bottle Size
15. R2 Volume
16. R2 Pos.
17. R2 Bottle Size
18. R3 Volume
19. R3 Pos.
20. R3 Bottle Size
21. Calib.Type(Type
22. Calib.Type(Wght
23. Calib. Conc. 1
24. Calib. Pos.  1
25. Calib. Conc. 2
26. Calib. Pos.  2
27. Calib. Conc. 3
28. Calib. Pos.  3
29. Calib. Conc. 4
30. Calib. Pos.  4
31. Calib. Conc. 5
32. Calib. Pos.  5
33. Calib. Conc. 6
34. Calib. Pos.  6
35. S1 ABS.
36. K Factor
37. K2 Factor
38. K3 Factor
39. K4 Factor
40. K5 Factor
41. A Factor
42. B Factor
43. C Factor
44. SD Limit
45. Duplicate Limit
46. Sens. Limit
47. S1ABS.Limit(L)
48. S1ABS.Limit(H)
49. ABS.Limit
50. ABS.Limit(D/I)
51. Prz.Limit
52. Prz.Limit(U/D)
53. Prz.(End Point)
54. Expect.Value(L)
55. Expect.Value(H)
56. Instr.Fact.(a)
57. Instr.Fact.(b)
58. Key Setting
```

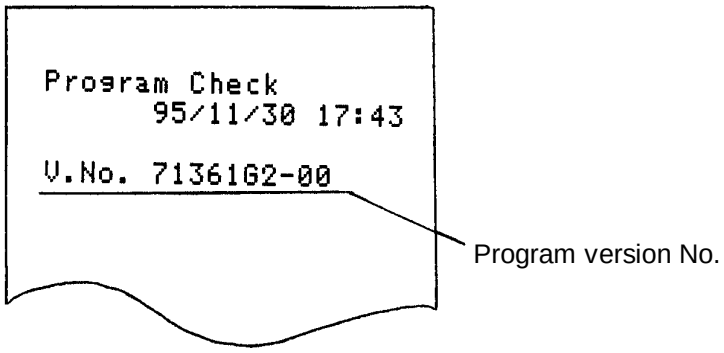
(1) Parameter Printout

Table 2-3 Contents of Printout

(O: Printed ×: Not printed)

Numerical Input from Screen	Contents of Printout	Without ISE	With ISE	Remarks
0	Title	O	O	
1 to 37	Photometry assay parameter	O	O	
38 to 40	ISE parameter	×	O	
99	8calculation tests 8 compensation tests Control positions (1 to 5) Serum indexes Printing order Printing format (when with card printer) Set test Carry-over evasion System parameter DIP switch data	O (× for ISE-related tests)	O	

(2) Program Check Printout



2.6.3 Communication Trace

(1) Outline

The contents of communication between the analyzer and external system are printed according to the specification of "communication trace printout" on the mechanism check menu screen.

(2) Printing Items and Their Contents

Details are given in Table 2-4.

Table 2-4 Printing Items and Their Contents

Printing Item		Contents
Title		Title "Communication Trace," date and time are printed. The printing order of year, month and day depends on the date printout order specification.
Time		Communication start time – Communication end time (hour, minute, second) (hour, minute, second)
Communication mode	Transmission	AU → HOST
	Reception	HOST → AU
Error message		Refer to Table 2-5.
Example of communication text		Refer to the system I/F specification.

(3) Printout System

(a) Printout order
Sequential printout starting from the latest communication
(b) Presence/absence of error message and printout system
Details are given in Table 2-5.

Table 2-5 Presence/Absence of Error Message and Printout System

Error Message	Communication Mode	Contents of Error	Printout System (communication text example)	Remarks
None	Both transmission and reception	None (normal)	Only communication function No. and sample data	———
BCC SUM	HOST → AU	BCC error or checksum error	All data printed	In printout of communication text (example), an ASCII control code is converted into a character string and printed, and then line is fed and communication text is printed. (Note)
PARITY	HOST → AU	Parity error	All data printed	
FRAMING	HOST → AU	Framing error	All data printed	
OVER RUN	HOST → AU	Overrun error	All data printed	
FRAME	HOST → AU	Frame error	All data printed	
LENGTH	HOST → AU	Text length error	All data printed	
CHAR1	HOST → AU	Function character error	All data printed	
CHAR2	HOST → AU	Sample data error	All data printed	
CHAR3	HOST → AU	Test selecting information error	All data printed	
CHAR4	HOST → AU	Comment error	All data printed	
TIME OUT	Both transmission and reception	Transmission or reception time-out error	Only time point, communication mode and error message printed	———

NOTE: Control codes and corresponding character strings are listed in Table 2-8.

(4) Notes

(a) Printout is terminated by stop key input. Printout can be stopped after the contents of trace in one cycle have been printed.
(b) A text is printed on two lines when it is longer than 20 characters.

Table 2-6 Control Codes and Corresponding Character Strings Printed

Control Code (NEX)	Character String	Use in AU (Analyzer Unit)
00	NUL	
01	SOM	
02	STX	O
03	ETX	O
04	EOT	
05	ENQ	
06	ACK	
07	BEL	
08	BS	
09	NT	
0A	LF	O
0B	VT	
0C	FF	
0D	CR	O
0E	S0	
0F	S1	
10	DLE	
11	DC1	
12	DC2	
13	DC3	
14	DC4	
15	NAK	
16	SYN	
17	ETB	
18	CAN	
19	EM	
1A	SUB	
1B	ESC	
1C	FS	
1D	GS	
1E	RS	
1F	US	

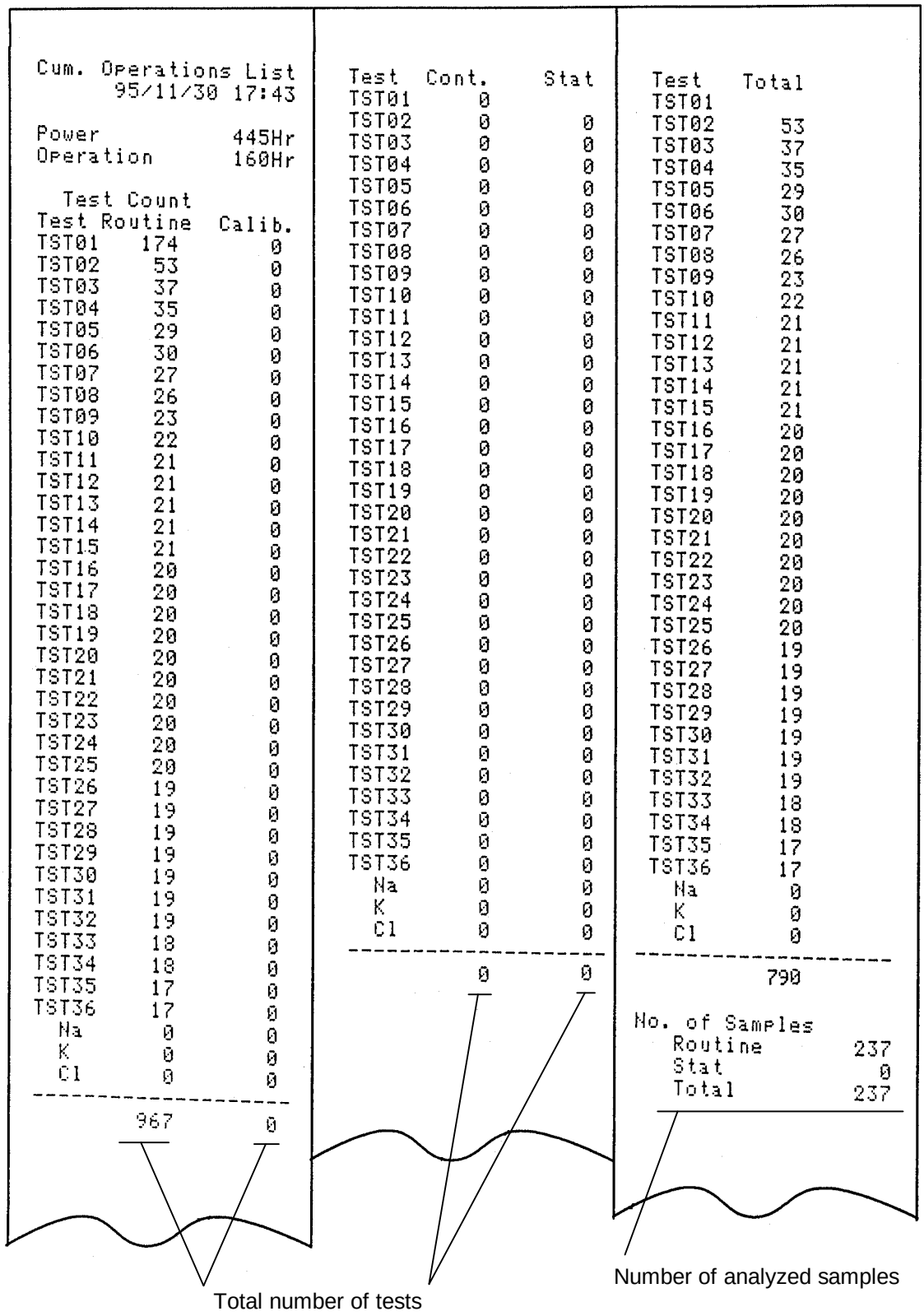
(5) Communication Trace Printout

```
      5    0     5     0
Communication Trace
       94/07/25  16:30

08:11:17 – 08:11:18
AU–>HOST
:A 10110ABCDEFG

08:11:11 – 08:11:12
HOST–>AU
:A 10110ABCDEFG

08:05:08 – 08:05:09
AU–>HOST
:A 10210ABCDEFG

08:05:00 – 08:05:01
HOST–>AU
?

08:04:10 – 08:04:11
AU–>HOST
:A 10210ABCDEFG

08:03:00 – 08:03:01
HOST–>AU CHAR. ERR
:A 05105ABCDEFGHIJKL
A0101010101010101010
10104
```

← Communication start and end time points
← Communication mode and error message
← Communication text example

2.6.4 Cumulative Instrument Operation List

1. Routine; Routine sample
2. Calib.; Calibration solution
3. Cont.; Control serum
4. STAT; Stat sample



Cum. Operations List
95/11/30 17:43

Power 445Hr
Operation 160Hr

Test	Count Routine	Calib.
TST01	174	0
TST02	53	0
TST03	37	0
TST04	35	0
TST05	29	0
TST06	30	0
TST07	27	0
TST08	26	0
TST09	23	0
TST10	22	0
TST11	21	0
TST12	21	0
TST13	21	0
TST14	21	0
TST15	21	0
TST16	20	0
TST17	20	0
TST18	20	0
TST19	20	0
TST20	20	0
TST21	20	0
TST22	20	0
TST23	20	0
TST24	20	0
TST25	20	0
TST26	19	0
TST27	19	0
TST28	19	0
TST29	19	0
TST30	19	0
TST31	19	0
TST32	19	0
TST33	18	0
TST34	18	0
TST35	17	0
TST36	17	0
Na	0	0
K	0	0
Cl	0	0
	967	0

Test	Cont.	Stat
TST01	0	
TST02	0	0
TST03	0	0
TST04	0	0
TST05	0	0
TST06	0	0
TST07	0	0
TST08	0	0
TST09	0	0
TST10	0	0
TST11	0	0
TST12	0	0
TST13	0	0
TST14	0	0
TST15	0	0
TST16	0	0
TST17	0	0
TST18	0	0
TST19	0	0
TST20	0	0
TST21	0	0
TST22	0	0
TST23	0	0
TST24	0	0
TST25	0	0
TST26	0	0
TST27	0	0
TST28	0	0
TST29	0	0
TST30	0	0
TST31	0	0
TST32	0	0
TST33	0	0
TST34	0	0
TST35	0	0
TST36	0	0
Na	0	0
K	0	0
Cl	0	0
	0	0

Test	Total
TST01	
TST02	53
TST03	37
TST04	35
TST05	29
TST06	30
TST07	27
TST08	26
TST09	23
TST10	22
TST11	21
TST12	21
TST13	21
TST14	21
TST15	21
TST16	20
TST17	20
TST18	20
TST19	20
TST20	20
TST21	20
TST22	20
TST23	20
TST24	20
TST25	20
TST26	19
TST27	19
TST28	19
TST29	19
TST30	19
TST31	19
TST32	19
TST33	18
TST34	18
TST35	17
TST36	17
Na	0
K	0
Cl	0
	790

No. of Samples
Routine 237
Stat 0
Total 237

Total number of tests

Number of analyzed samples

2.6.5 FD File Management

Usage	Drive 1		Drive 2		CRAM		CRAM	
	System Disk	Data Capacity (kb)	Data Disk	Data Capacity (kb)		Data Capacity (kb)		Data Capacity (kb)
Usual operation	1. Daily alarm (cyclic system) 500 cycles × 256B	128.0	1. Routine sample (1) Search table (ID) 400 × 16B	6.4	1 Cumulative instrument data (2) Remaining reagent volume	0.8 0.3	<Program> 1. Application program (including character string)	800
	2. Cumulative alarm (256-day cycle) 256 days × 512B + 100B	131.2	(2) Measured data 400 × 1408B	563.2	(3) Photometer check value (previous value)	0.1	3.0S <Work area>	400
	3. Control sample 38400B × 10 psc + 1000B	385.0	2. Stat sample (1) Search table 50 × 16B	0.8	4. Probe position adjustment data	0.05	1. Application work area 2. Work area for TM program	1500 400
	4. Parameters (analysis, system)	141.12	(2) Measured data 50 × 1408B	70.4	5. Routine sample sequence No.	0.01		
	5. Cell blank data 160 cells × 64B + 100B	10.34			(6) Reaction bath water replacement date information		<Data area> 1. Routine sample test selecting information	
							(1) Header block (400 samples)	13
							(2) Data block (400 samples)	103
							2. Measured data (routine, control, calibration)	400
							3. Original Abs (routine sample) Data of 35 samples	8
At maintenance	6. Encircled data in C-RAM column				Encircled items: Subject to C-RAM R/W		<Parameters> <Determined data>	32.0
	7. Routine sample test select information 400 samples × 256B + 400 × 16B	108.8					<Other> 1. Communication trace	32.0
At installation	Disk for installation (compression) 1. Application program 2. Time chart program 3. OS 4. Screen data		Unnecessary				2. DIP SW data	0.02
Maximum necessary storage capacity (kb)		904.46		640.8		2.96		3688.02
Maximum storage capacity (kb)		1440		1440		3	8000 at development	8000

NOTES: 1. The usable area on the application side of CRAM is 3 KB.
2. After FD formatting (in IBM-compatible format), disk capacity is 1.44 MB. However, because of 512 bytes/cluster, too many files will degrade memory storage efficiency.
3. Both system disk and data disk must have an FD file format of MS-DOS.

3. FLOW PATH DIAGRAMS

3.1 List of Solenoid Valves.....3-1

3.2 Overall Piping Diagramm.....3-2

3.3 Flow Rate at Each Location 3-3

3.4 WASH 3-4
3.4.1 Details of WASH Processing.....3-5

3.5 Carry-over Evasion Function.....3-6

3. FLOW PATH DIAGRAMS

3.1 List of Solenoid Valves

SV No.	2-way/ 3-way	Type	Open/Close When Energized	Voltage	Maker	Application	Part No.
SV 1	2-way	A2-5617	Open	24 V DC	CKD	Water supply intake	713-0321
SV 2	2-way	HB-11-X0185	Open	24 V DC	CKD	Sample syringe	713-1059
SV 3	2-way	HB-11-X0185	Open	24 V DC	CKD	Reagent syringe	713-1059
SV 4	2-way	HB-11-X0193	Open	24 V DC	CKD	Incubation bath water intake	713-1379
SV 5	2-way	HB-11-X0193	Open	24 V DC	CKD	Stirring and washing water supply	713-1379
SV 6	2-way	HB-11-X0193	Open	24 V DC	CKD	Reagent probe outside washing water supply	713-1379
SV 8	2-way	HB-11-X0193	Open	24 V DC	CKD	Sample probe outside washing water supply	713-1379
SV 9	2-way	HB-11-X0193	Open	24 V DC	CKD	Rinsing and nozzle tip washing water supply	713-1379
SV 10	2-way	HB-11-X0193	Open	24 V DC	CKD	Rinsing and cell blank water supply	713-1379
SV 11	3-way	A2-5619	–	24 V DC	CKD	Rinsing and cell washing water supply	707-0290
SV 12	2-way	NTV-2-HN	Open	24 V DC	Takasago	Waste solution discharge (low concentration)	713-0331
SV 13	2-way	NTV-2-HN	Open	24 V DC	Takasago	Waste solution discharge (high concentration)	713-0331
SV 14	3-way	NRV	–	24 V DC	Takasago	Vacuum tank (evacuation)	713-0332
SV 15	2-way	A2-5618	Open	24 V DC	CKD	Incubation bath water discharge	713-0320
SV 16	2-way	MTV-21-SM6M	Open	24 V DC	Takasago	ISE syringe	713-0317
SV 17	2-way	MTV-21-SM6M	Open	24 V DC	Takasago	ISE sample discharge	713-0324
SV 18	2-way	MTV-21-SM6M	Open	24 V DC	Takasago	ISE and REF aspiration	713-0325
SPV 1	Pinch valve	SD10BA-2A-00T	Open	24 V DC	Advance	ISE aspiration	707-0327

3.2 Overall Piping Diagram

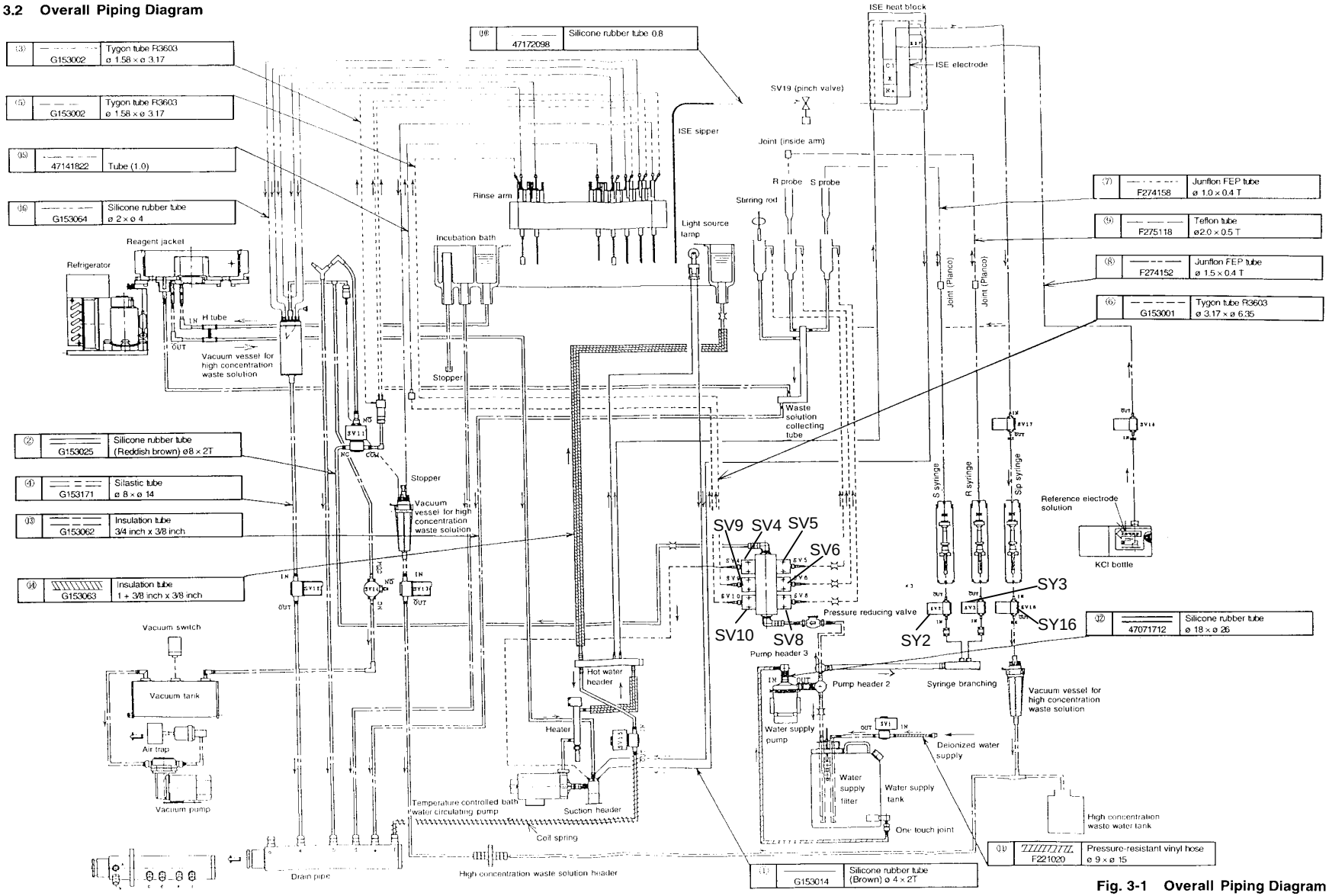

③ G153002 Tygon tube R3603 ø 1.58 × ø 3.17
⑤ G153002 Tygon tube R3603 ø 1.58 × ø 3.17
⑮ 47141822 Tube (1.0)
⑩ G153064 Silicone rubber tube ø 2 × ø 4
⑩ 47172098 Silicone rubber tube 0.8
② G153025 Silicone rubber tube (Reddish brown) ø8 × 2T
④ G153171 Silastic tube ø 8 × ø 14
⑬ G153062 Insulation tube 3/4 inch x 3/8 inch
⑭ G153063 Insulation tube 1 + 3/8 inch x 3/8 inch
⑦ F274158 Junflon FEP tube ø 1.0 × 0.4 T
⑨ F275118 Teflon tube ø2.0 × 0.5 T
⑧ F274152 Junflon FEP tube ø 1.5 × 0.4 T
⑥ G153001 Tygon tube R3603 ø 3.17 × ø 6.35
⑫ 47071712 Silicone rubber tube ø 18 × ø 26
⑪ F221020 Pressure-resistant vinyl hose ø 9 × ø 15
① G153014 Silicone rubber tube (Brown) ø 4 × 2T
ISE heat block
ISE electrode
SV19 (pinch valve)
ISE sipper
Joint (inside arm)
R probe
S probe
Stirring rod
Rinse arm
Light source lamp
Incubation bath
Reagent jacket
Refrigerator
H tube
Vacuum vessel for high concentration waste solution
Stopper
Waste solution collecting tube
Joint (Plarico)
S syringe
R syringe
Sp syringe
Reference electrode solution
KCl bottle
SV9 SV4 SV5 SV6
SV10 SV8
Pressure reducing valve
SY2 SY3 SY16
Pump header 3
Pump header 2
Syringe branching
Vacuum vessel for high concentration waste solution
Water supply pump
Deionized water supply
Water supply filter
Water supply tank
One touch joint
High concentration waste water tank
Vacuum switch
Vacuum tank
Air trap
Vacuum pump
Hot water header
Heater
Temperature controlled bath water circulating pump
Suction header
Coil spring
Drain pipe
High concentration waste solution header

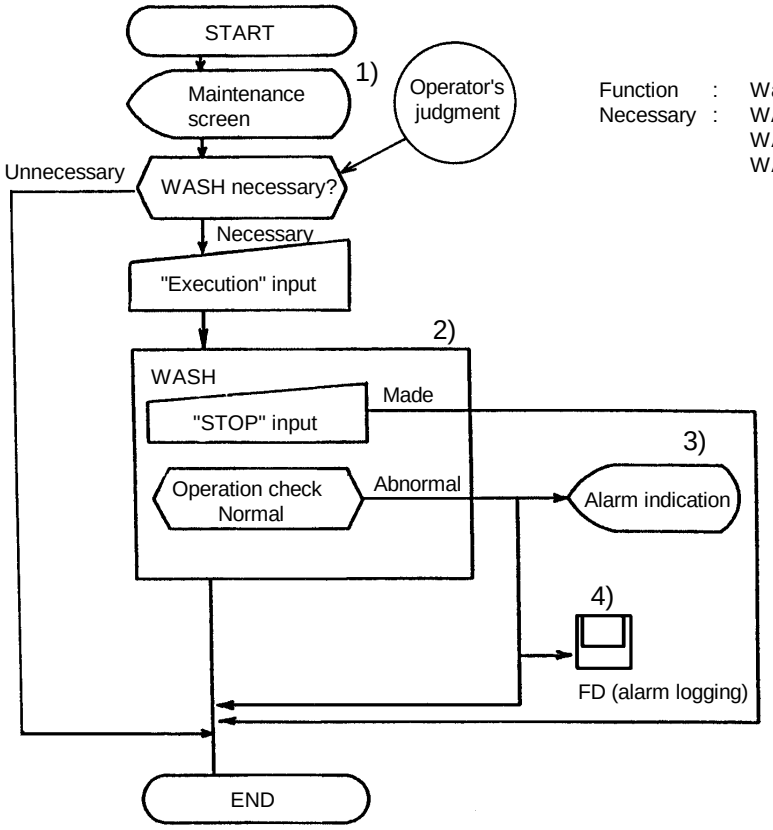
Fig. 3-1 Overall Piping Diagram

3.3 Flow Rate at Each Location

Location		Flow Rate mL/min	Remarks
S probe	Outside washing	270 ± 30	SV unit restrictor ø1.5/tube L = 80, restrictor ø1.0/tube L = 650 Tube = Tygon ø3.17 × ø6.35
	Inside washing	35 ± 5	
R probe	Outside washing	270 ± 30	SV unit restrictor ø1.5/tube L = 80, restrictor ø1.0/tube L =820 Tube = Tygon ø3.17 × ø6.35
	Inside washing	120 ± 20	
Stirring and washing		320 ± 30	SV unit restrictor ø1.5/tube L = 80, restrictor ø1.15/tube L = 1000 Tube = Tygon ø3.17 × ø6.35
Rinsing	High concentration waste solution probe	90 ± 10	SV11/branch tube/tube L = 395/high concentration waste solution probe Tube = Tygon ø2.38 × ø3.96 Restrictor ø1.0
	Low concentration waste solution probe	90 ± 10	Same as above
Cell blank washing		450 ±150 (µL/0.8 sec)	SV unit restrictor ø1.5/tube A = 580, specials/tube B = 500 Tube A = Tygon ø3.17 × ø6.35, tube B = Silastic tube ø1.0 × ø3.0
Nozzle tip washing		140 ± 15	SV unit restrictor ø1.5/tube L = 1080 Tube = Tygon ø2.38 × ø3.96
Incubation bath flow rate			After pouring water into the incubation bath with cells set, flow velocity on water surface should be measured with cells removed (in sec/circumference).
Returning from water supply pump		3.7 ± 0.2 (L/min)	
Flow rate through lamp		0.30 or more (L/min)	Measure with the lamp coolant tube disconnected at the lamp inlet.

3.4 WASH

3.4.1 Details of WASH Processing



Function : Washing of each mechanism
Necessary : WASH (cell) 15 min 20 sec
WASH (ISE) 5 min 44 sec
WASH (All) 20 min 20 sec

Step No.	Contents of Processing	Reference Document
1)	Start from MAINTENANCE screen	Screen specifications
2)	See next page	
3) 4)	When mechanism operates, its operation is checked. If abnormal, alarm is indicated. Alarm will be saved into the alarm FD.	Screen specifications Alarm code table FD specifications

Remarks: (1) Start method and resulting action

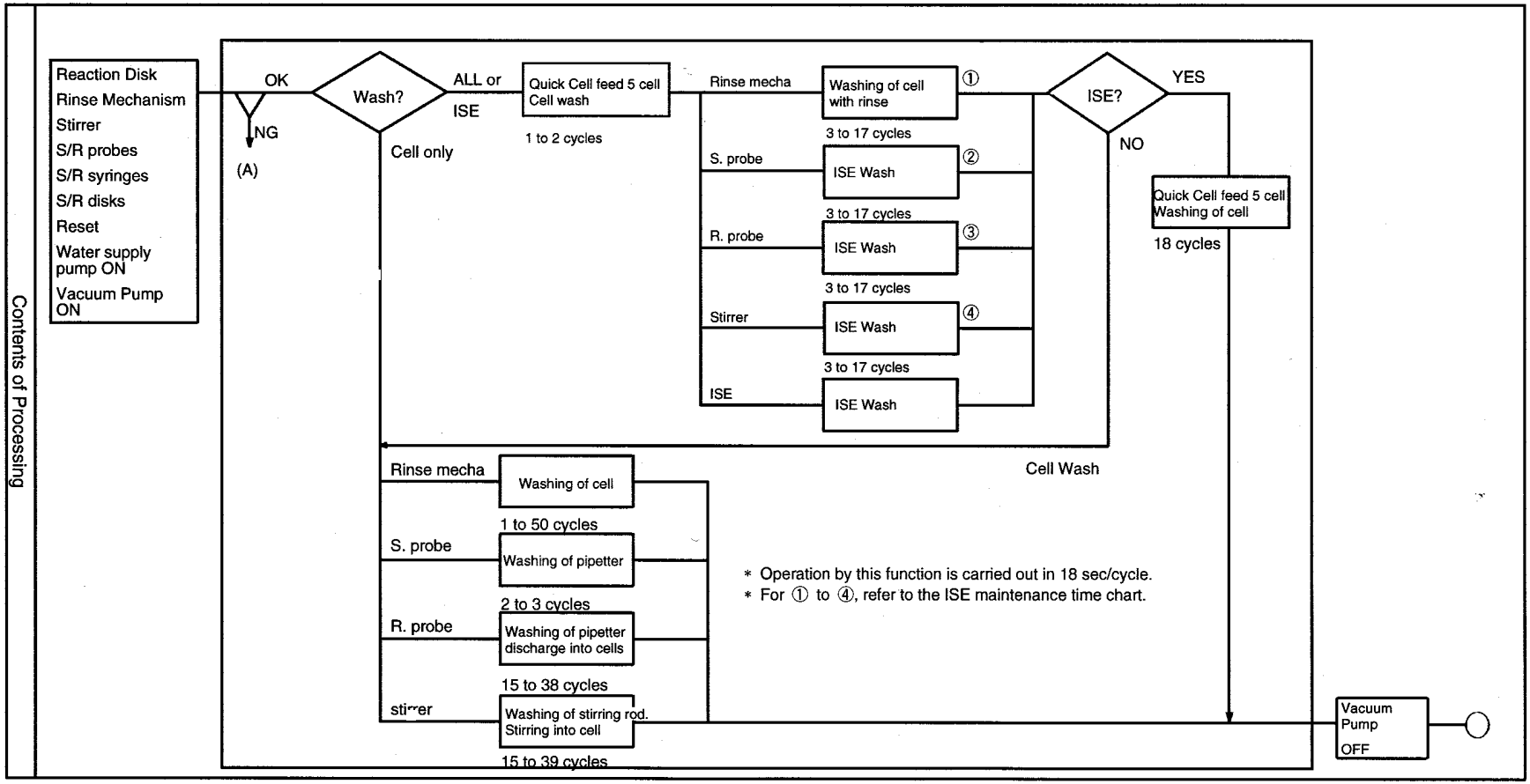
(a) Specify DAILY.
All cells, probes (S and R), stirrer and ISE mechanism are washed.

(b) Specify reaction cell.

(c) Specify ISE.
The ISE mechanism is washed.

NOTE: Specification of ISE for WASH
when without ISE mechanism ..... Input cannot be made from the screen.
Specification of all mechanisms
when without ISE mechanism ..... Operation is carried out according to "cell" specification.

Details of WASH Processing



3.5 Carry-over Evasion Function

(1) Outline

The carry-over evasion function is provided to prevent occurrence of inaccurate data due to sample carry-over in photometry assay and ISE tests.
This function works on routine samples alone and does not work on calibrator and control samples. Carry-over is evaded by changing the measuring sequence among the reagents or samples, which may cause carry-over, or by execution of washing. The kinds of evasion/washing are listed below.

(a) Evasion of reagent carry-over due to reagent probe and washing for evasion
(b) Evasion of carry-over between reagents due to cell and washing for evasion
(c) Evasion of sample carry-over due to sample probe and washing for evasion

(a) Evasion of reagent carry-over due to reagent probe and washing for evasion

(I) Condition for carry-over evasion
When the evasion of reagent carry-over due to reagent probe is set, it is attempted at first by changing the reagent sampling sequence (test sequence). If this method is unusable, carry-over evasion by washing is executed. That is, when the sequence of pipetting reagents (R1 to R3) with the reagent probe matches the specified pattern, carry-over is prevented by (i) to (iii) below. In (ii) and (iii), throughput is degraded.

(i) For avoiding the relevant pattern, channel registration is changed for a different test within the test sequence of the same sample.
(ii) When step (i) cannot be taken, a channel is registered after reagent probe washing cycle.
(iii) Cell is made blank and the system waits till deviation from the specified pattern.

(II) Method of carry-over evasion
The reagent probe is washed by aspirating detergent (detergent 1 or 2) or system water (distilled water for washing the inside of probe) and discharging it into a cell. At this time, the stirring rod is also washed in that cell.

(III) Carry-over evasion-specified pattern
The patterns, for which the evasion of carry-over between reagent types is specified, are listed below.
"$\rightarrow$ ALL" indicates that evasion is required in all types of R1, R2 and R3.
ALL represents 3 reagent types for 3-reagent system, and 2 reagent types for 2-reagent system.

R3 $\rightarrow$ R3, R3 $\rightarrow$ R2, R3 $\rightarrow$ R1,
R2 $\rightarrow$ R3, R2 $\rightarrow$ R2, R2 $\rightarrow$ R1,
R1 $\rightarrow$ R3, R1 $\rightarrow$ R2, R1 $\rightarrow$ R1

(IV) Registration of carry-over evasion-specified pattern
Up to 40 kinds of patterns, for which the evasion of carry-over due to the reagent probe is specified, can be registered.

(V) Probe washing cycle

Probe washing employs one (1) machine cycle.

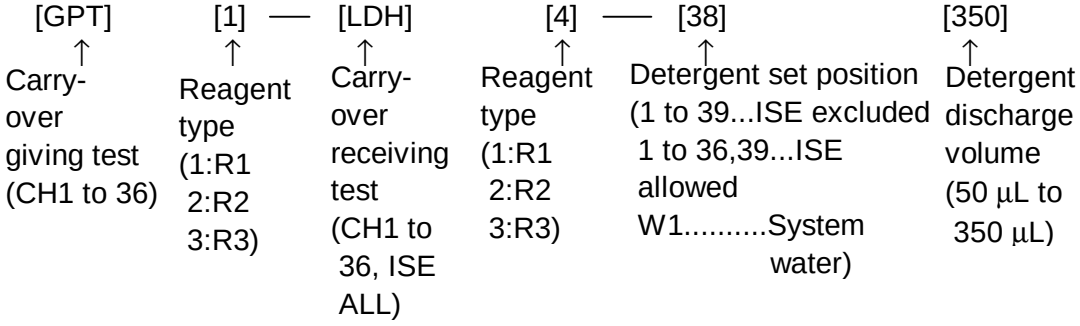
Within one machine cycle, the specified detergent (system water) placed on the reagent disk is aspirated in the specified volume and discharged into the cell at the same timing as for reagent aspiration and discharge.

(VI) Measure for ISE

Of the reagents for ISE, the internal standard solution and diluent are applicable to carry-over evasion. Carry-over evasion cannot be specified for reference electrode solution.

(VII) Specification from screen

From the screen, the following need be specified; a carry-over giving test and its reagent type (R1, R2, R3), a carry-over receiving test and its reagent type (R1, R2, R3), detergent set position on the reagent disk and detergent volume. An example of specification is shown below.


[GPT]
[1] —— [LDH]
[4] —— [38]
[350]
Carry-over giving test (CH1 to 36)
Reagent type (1:R1 2:R2 3:R3)
Carry-over receiving test (CH1 to 36, ISE ALL)
Reagent type (1:R1 2:R2 3:R3)
Detergent set position (1 to 39...ISE excluded 1 to 36,39...ISE allowed W1.....System water)
Detergent discharge volume (50 µL to 350 µL)

(VIII) Examples of evading procedure

Examples of carry-over evading procedure are shown below.

A to C represent tests, and W stands for washing.

Example of Carry-over Evasion-specified Pattern	Example of Evading Procedure
$A_{R3} \rightarrow B_{R2}$	$A_{R3} \rightarrow C_{R2}$ (example of succeeding in evasion by change in channel registration)
$A_{R3} \rightarrow B_{R3}$	$A_{R3} \rightarrow W \rightarrow B_{R3}$
$A_{R3} \rightarrow B_{R1}$	$A_{R3} \rightarrow W \rightarrow B_{R1}$

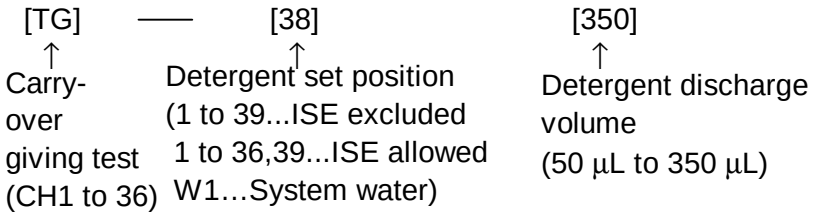
(b) Evasion of carry-over between reagents due to cell and washing for evasion

(I) Condition for carry-over evasion
The cell used for analysis of the specified test is not used for analysis in the next round (after 48 cycles). Instead, it is washed for prevention of carry-over.

(II) Method of carry-over evasion
Cell is washed by aspirating detergent (detergent 1 or 2) or system water and discharging it into a cell. At this time, washing is facilitated by stirring.
Carry-over evasion of cell is also effected during S. Stop. After completion of washing all cells, auto stop occurs.
When stop status is set for any cause other than auto stop, cell washing for evading carry-over due to the previous operation will not be resumed in start from the standby status.
Execution of cell washing degrades throughput.

(III) Registration of carry-over evasion-specified pattern
Up to 10 kinds of patterns, for which the evasion of carry-over due to cell is specified, can be registered.

(IV) Specification from screen
From the screen, the following need be specified; a carry-over giving test, detergent set position on the reagent disk and detergent volume.
An example of specification is shown below.


[TG]
[38]
[350]
Carry-over giving test (CH1 to 36)
Detergent set position (1 to 39...ISE excluded 1 to 36,39...ISE allowed W1…System water)
Detergent discharge volume (50 µL to 350 µL)

(V) Cell washing cycle
When detergent discharge volume exceeds 350 µL, detergent is discharged by using 2 timings among the 3 timings (R1, R2, R3) for reagent aspiration and discharge in one cycle.

(VI) Example of evading procedure
An example of carry-over evading procedure is shown below.
A to E represent tests, and W stands for washing.

Carry-over Evasion-specified Test	Example of Evading Procedure
A	a-th cycle..... B — A — C..... (a -1)th cycle..... D — W — E.....

(c) Evasion of sample carry-over due to sample probe and washing for evasion

(I) Condition for carry-over evasion
Sample carry-over is prevented by washing the sample probe.

(II) Method of carry-over evasion
The sample probe is washed at the timing just before pipetting the sample whose measurement includes a sample carry-over washing-specified test (between sample pipettings).
The sample probe is washed by the following method. The determined volume (65 µL) of detergent is aspirated from the specified washing cup on the sample disk and discharged into the washing bath where the sample probe is washed with water. At this time, stirring is not made.

(III) Tests with sample probe washing
Tests of control sample and standard solution are excluded.

(IV) Sample probe washing cycle
The sample probe is washed in one cycle time. Washing of the sample probe will not degrade throughput.

(V) Registration of carry-over evasion-specified pattern
Up to 8 kinds of patterns, for which the evasion of carry-over due to the sample probe is specified, can be registered.

(VI) Specification from screen
From the screen, the following need be specified; a test, for which washing of the sample probe is specified for carry-over evasion, and the detergent set position on the sample disk. An example of specification is shown below.

[AFP] —— [W1]
↑ ↑
Carry-over giving test (CH1 to 36)
Detergent set position (W1, W2, W3)

(VII) Examples of evading procedure
An example of carry-over evading procedure is shown below.
A to C represent tests, and W stands for washing.

Carry-over Evasion-specified Test	Example of Evading Procedure
A	..... B — W — A — B — C — W — A — W — A — B Sample i Sample i+1 Sample i+2 Sample i+3

(2) Priority of Carry-over Washing

On concurrence of multiple carry-over washing timings, priority is given on the principle below.

(a) Cell washing > probe washing
When the cell used for reagent probe washing requires washing, priority is given to cell washing. On this occasion, probe washing is carried out after cell washing. However, when use of the detergent at the same reagent position is specified for both reagent probe washing and cell washing, the reagent probe washing step can be substituted by the cell washing process. Therefore, only the cell washing is carried out omitting the reagent probe washing.

(b) As for sample probe washing and cell washing, priority is given to cell washing.

(c) For sample probe washing and reagent probe washing, priority is given to sample probe washing.

(d) When reagent probe washing R1, R2 or R3 and cell washing become necessary simultaneously with the same cell, the next cell can be used for preventing overflow if the total volume in a cell exceeds 540 µL.

4. BLOCK DIAGRAMS

4.1 Model 902 Operating Principle 4-1

4.2 Principle of 902 4-2
4.2.1 Measuring Principle 4-2

4.3 Block Wiring Diagramm 4-6

4. BLOCK DIAGRAMS

4.1 Model 902 Operating Principle

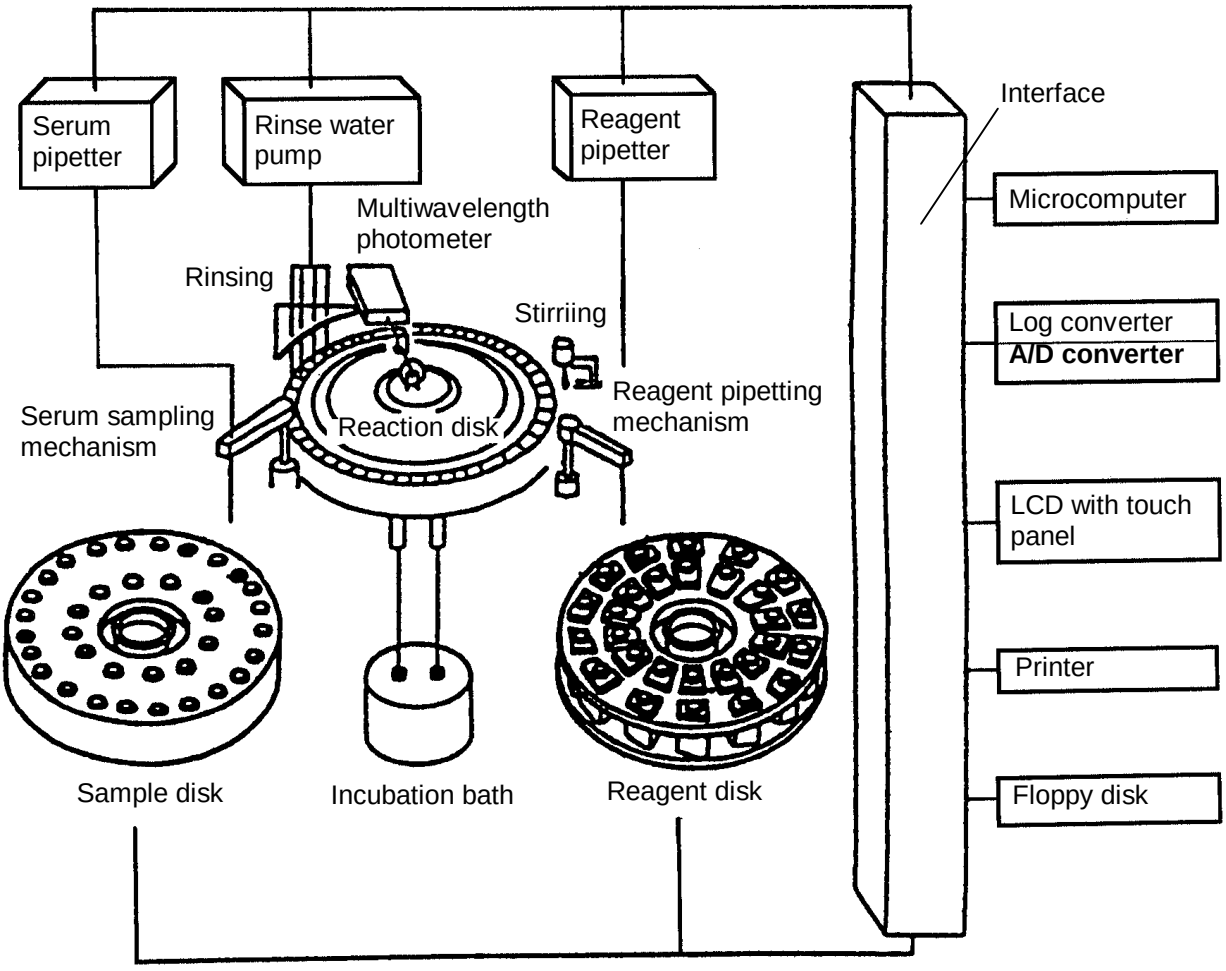


Fig. 4-1 System Configuration of 902

4.2 Principle of 902

4.2.1 Measuring Principle

The measuring principle of the 902 will be explained by dividing it into operation of mechanisms, analytical flow, and operating position.

(1) Operation of Mechanisms

The 902 consists of sample disk, sampling mechanism, reagent disk, reagent pipetting mechanism, reaction disk, reaction bath, stirring mechanism, rinse mechanism, photometric system, touch screen type LCD, etc. The analytical operation will be explained with reference to the 902 system configuration in Fig. 4-1.

(a) Set sample cups or test tubes containing sample on the sample disk and reagent on the reagent disk. Also set the test items requested for the samples plus the measurement conditions on the LCD. At the start of analysis, the operations below will be carried out automatically.

(b) Reaction cuvette rinsing and water blank measurement
The reaction cuvettes are rinsed, and the absorbance of the cuvettes (containing water) is measured four times. The measured value becomes the water blank value for each cuvette. After completion of the water blank measurement, the water is aspirated from the cuvettes.

(c) Sampling
After water blank measurement, the reaction cuvette rotates to the sample pipetting position, the sample disk turns and the sample cup or test tube containing sample is brought to the sampling position. The sample probe then moves to above the sample cup or test tube, and descends into it. A liquid level sensor is attached to the probe, which stops the probe descent when the tip of the probe contacts the surface of the sample. The necessary volume of sample for analysis is aspirated by the sample pipetter. The sample probe then moves to above the reaction cuvette at the sample pipetting position and descends until the probe tip reaches the bottom of the cuvette, whereby the sample is discharged. Thereafter the probe moves to the probe rinse bath where its inside and outside are rinsed with deionized water.

(d) 1st reagent addition and stirring
When the reaction cuvette containing discharged sample stops at the 1st reagent adding position, the reagent pipetting mechanism aspirates the required volume of reagent. Then the reagent probe moves to above the reaction cuvette and discharges the reagent. A liquid level sensor is also attached to the reagent probe, which stops the probe when its tip contacts the surface of the reagent. The necessary volume of reagent is discharged by the reagent pipetter. After the reagent discharge, the probe moves to the probe rinse bath where its inside and outside are rinsed with deionized water. After the 1st reagent addition, the reacting solution is stirred by the stirring mechanism. And after the stirring, the stirring rod is thoroughly rinsed with the rinse water.

(e) Photometry
After addition of the 1st reagent, measurement of absorbance of the reacting solution starts. The absorbance during the reaction is measured at 18-second intervals.

(f) 2nd and 3rd reagent addition and stirring
About 1.5 minutes later, the 2nd reagent is added to the reaction cuvette, and about 5 minutes later the 3rd reagent is added. As with the 1st reagent addition, the reagent pipetting mechanism aspirates the reagent and the necessary volume is discharged into the reaction cuvette from the reagent probe. After discharging each reagent, the reacting solution is stirred by the stirring mechanism. Note that if the reagent pipetting volume is not set in the analytical parameters for a certain reagent (1st to 3rd), the addition and stirring for that reagent will not be made. Also, stirring without reagent pipetting can be specified as well.

(g) Rinsing
At the completion of analysis, the reacting solution is aspirated and drained and deionized water is injected into the reaction cuvettes to rinse them out.

(h) Analytical result output
The measured absorbance data undergoes concentration conversion at the data processor, is output to the printer, transferred online to the host computer and saved in a floppy disk. Values from which the water blank value is subtracted are used for the data processing.

(2) Analytical Flow

Figure 4-2 shows the flow of analysis.

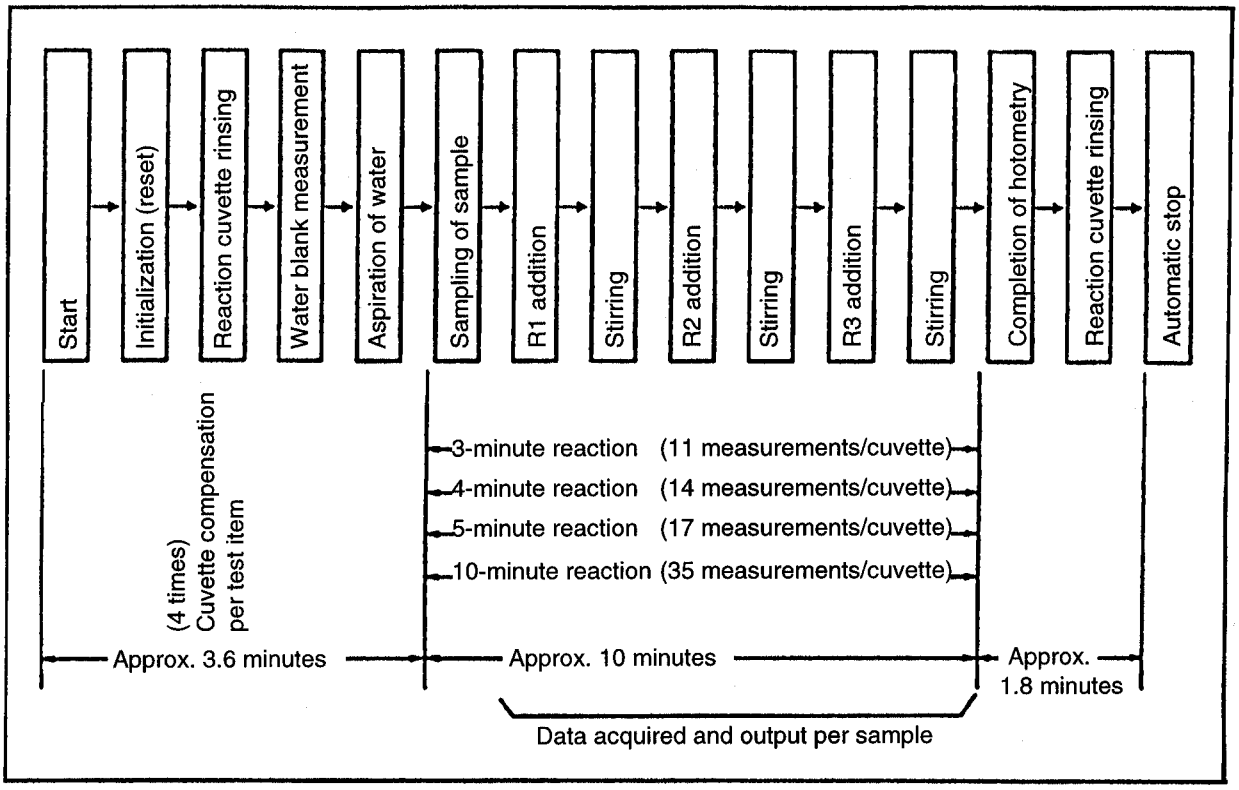


Fig. 4-2 Flow of Analysis

(3) Operating Position

Figure 4-3 shows the operating position of each mechanism around the reaction disk.

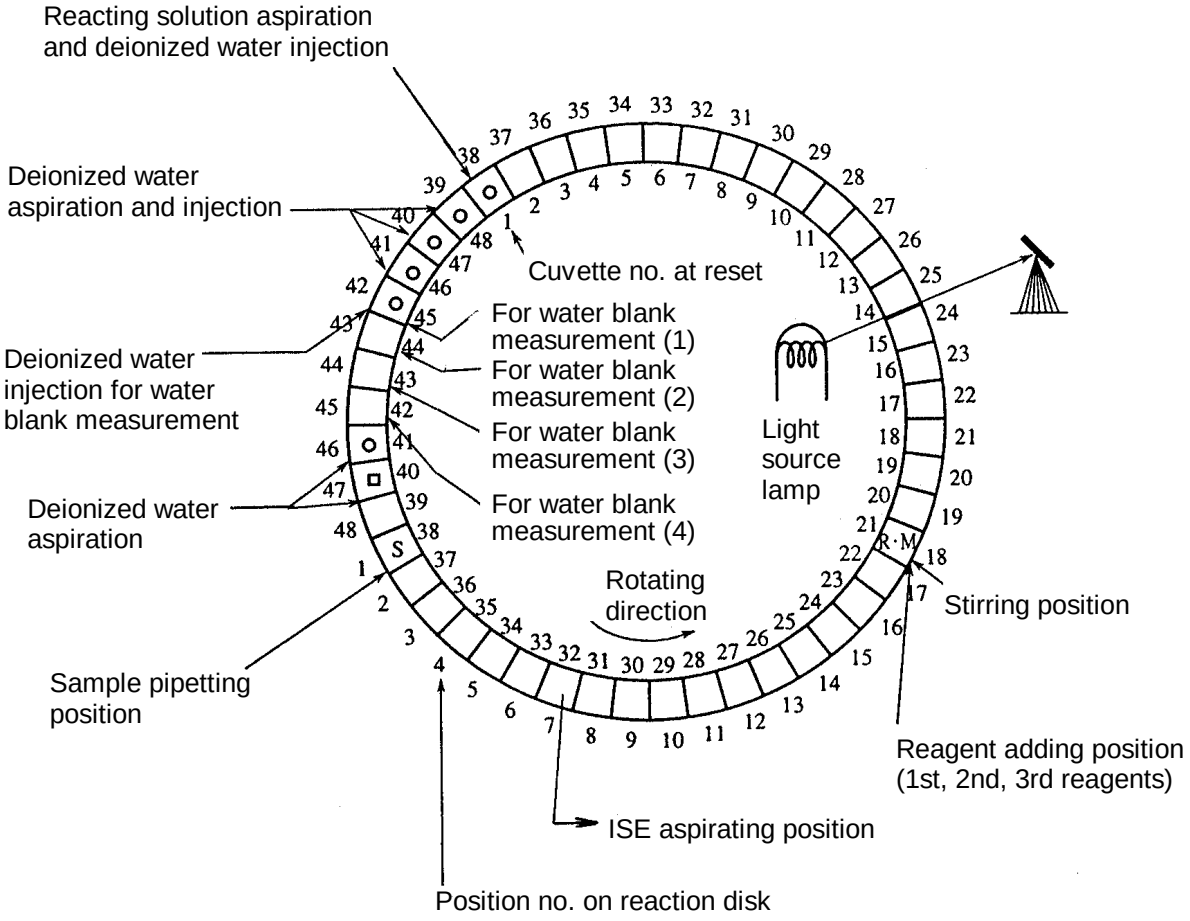
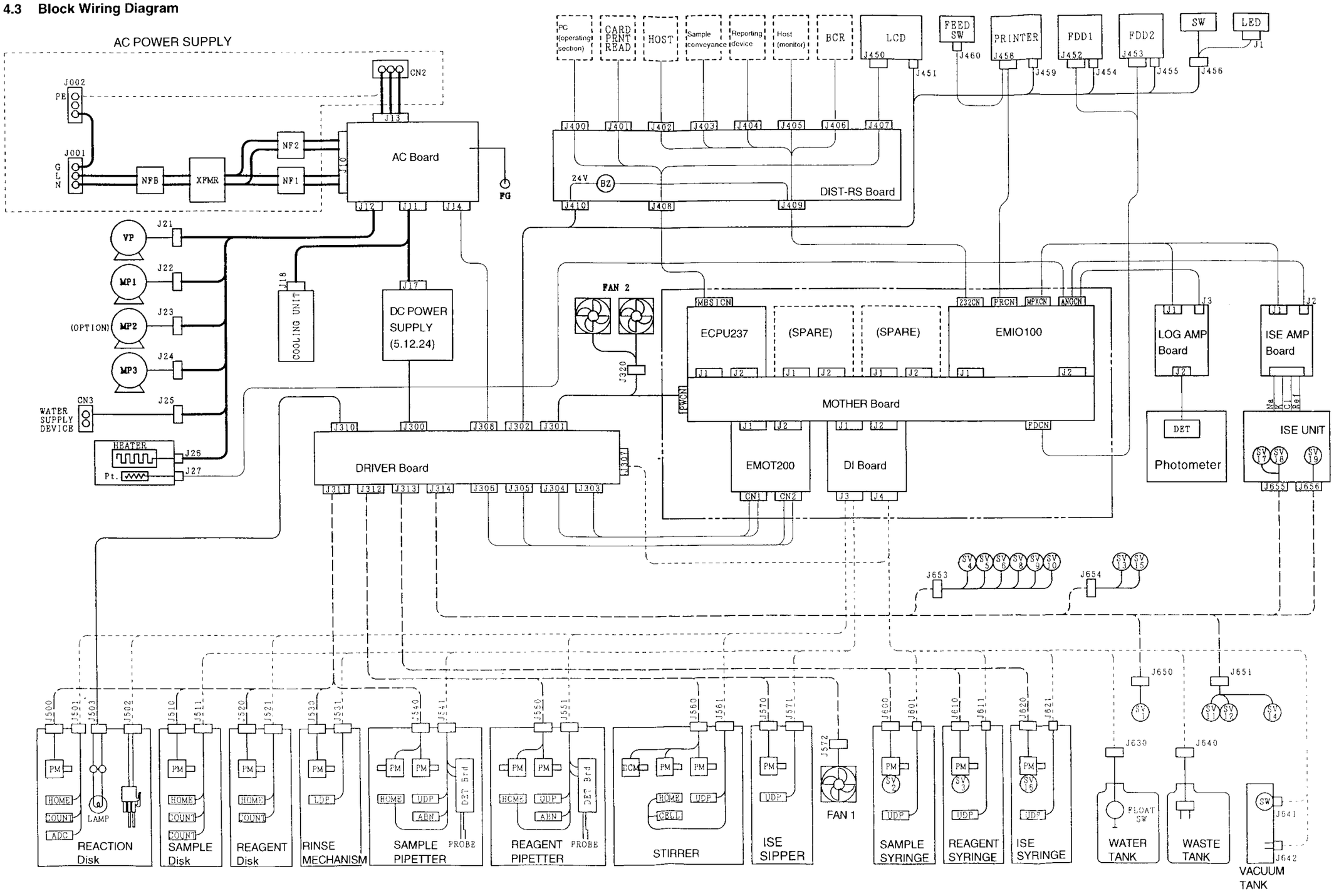

Reacting solution aspiration and deionized water injection
Deionized water aspiration and injection
Deionized water injection for water blank measurement
Deionized water aspiration
Sample pipetting position
Cuvette no. at reset
For water blank measurement (1)
For water blank measurement (2)
For water blank measurement (3)
For water blank measurement (4)
Light source lamp
Rotating direction
Stirring position
Reagent adding position (1st, 2nd, 3rd reagents)
ISE aspirating position
Position no. on reaction disk
S
R·M

Fig. 4-3 Operating Position of Each Mechanism around the Reaction Disk

4.3 Block Wiring Diagram



5. ISE

5.1 Functional Specifications of Model 902 ISE. 5-1

5.2 Outline of ISE Unit..... 5-2

5.3 Configuration of ISE Hardware..... 5-5

5.4 ISE Measurement Sequence 5-6

5.5 ISE A/D Conversion 5-8

5.6 Flow Path Diagram..... See section 3.

5.7 Time Chart 5-9

5.8 Cross Wiring Reference ..... See section 11.

5.9 Circuit Diagrams..... See section 12.

5. ISE

5.1 Functional Specifications of Model 902 ISE

Item	Specification	
Measurable samples	Serum, urine, blood plasma	
Measuring temperature	35 ± 2°C	
Throughput	Continuous measurement	100 samples/hr max.
Measurement system	Dilution to 1/50	Sample volume: 10 µL Dilution volume: 490 µL
Data accuracy	Data reproducibility	Simultaneous reproducibility: Serum CV ≤ 1% (N = 30) Urine CV ≤ 2%
	Data accuracy	Normal standard serum: Na, Cl ±1.5 mmol/L K ±0.1 mmol/L
Measuring concentration range	Serum	Na : 80 to 180 mmol/L K : 1.5 to 10 mmol/L Cl : 60 to 120 mmol/L
	Urine	Na, Cl : 10 to 250 mmol/L K : 1 to 100 mmol/L
Maintenance	Rinsing operation	Kind : Daily Method : Automatic, pipetting from sample cup
	Reagent priming	Internal standard, reference electrode solution
	Potential measurement	Measurement of electromotive force of Na/K/Cl in stand-by status
Sampling	Upon simultaneous request for photometry and ISE	Priority given to ISE for calibrator, routine sample and control sample
Printout	Upon independent request for ISE	Data printed out immediately after calculation

5.2 Outline of ISE Unit

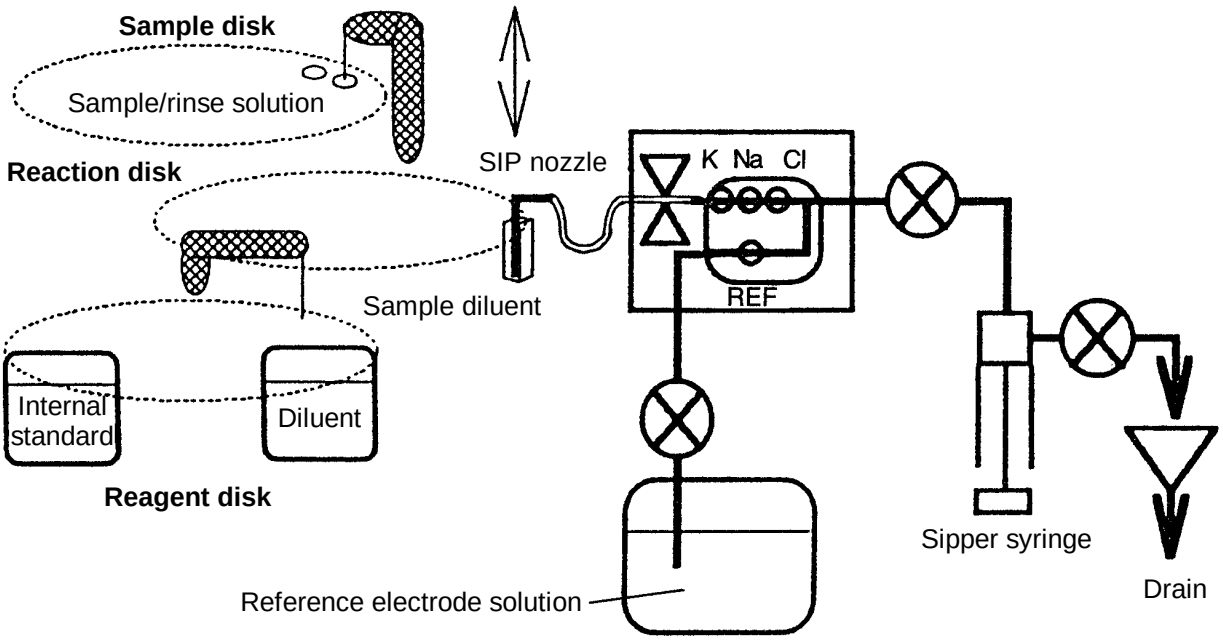
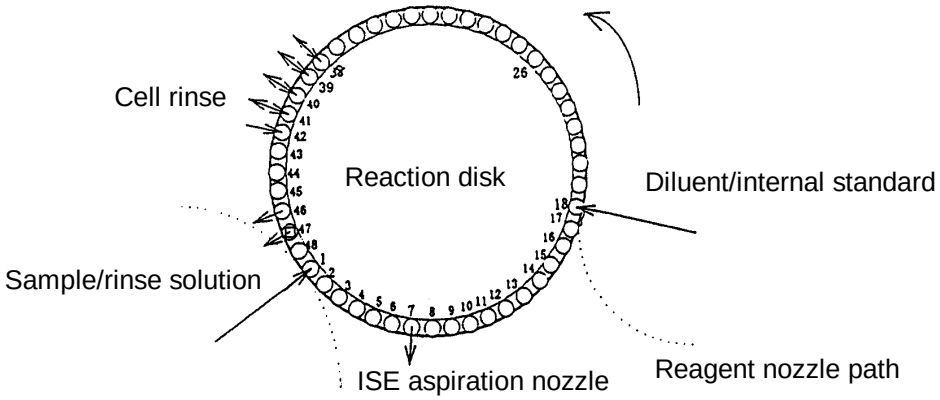


Fig. 5-1 ISE Principle

(1) Movement of Reaction Disk (Model 902)



The reaction sequence consists of processes carried out while the reaction disk provided with 48 cells turns one revolution on 48 cycles.

The processes are classified into operation process and measurement process.

Process	Work	Photometry	ISE	Cell Position
Operation	Sample pipetting	●	●	1
	Reagent pipetting/stirring (R1, R2, R3)	●	●	18
	Electrode aspiration		●	7
	Cell rinse	●	●	38 to 47
Measurement	Cell blank measurement	●		26
	Reaction monitor photometry	●		26

For ISE analysis, two cells are required for each sample (one cell for sample and the other for internal standard solution).

No.	Operation Sequence	Photometry	ISE	
			Sample	Internal Standard
1	S pipetting into cell 1 and R3 pipetting into cell 18	●	●	
2	Stirring of cell 18 at same position	●		
3	12-step feed and R2 pipetting into cell 6	●		
4	Stirring of cell 6 at same position	●		
5	5-step feed and R1 pipetting into cell 1	●	●	●
6	Stirring of cell 1 at same position	●	●	
7	Measurement at cell position 26 which passes optical axis at intervals of 18 sec and data acquisition	●		
8	Aspiration of solution at cell position 7 into electrode after 6-cycle turning		●	●
9	Rinsing of cell after lapse of 10-minute reaction time at cell position 38 to 47	●	●	●
10	Feed of cell 48 to S pipetting position	●	●	●
11	Repetition of no. 1 to 10 on 18-second cycle	●		

(2) Mechanical Operation when Sample is Short

Condition of Alarm Occurrence	Sample Aspiration	ISE Diluent	Sipper Aspiration	Data Output	Internal Standard Solution
(A)	×	×	×	×	×
(B)	O	O	×	×	O

For details of (A) and (B), refer to the specifications of the sample probe.
(Sample probe alarm occurrence conditions and mechanical operation)

(3) Error Handling

Upon occurrence of error in ISE hardware, WARNING or STOP alarm is issued.
For the sample already pipetted into the cell, data is not output if an error occurs before sipper aspiration (because data is not verified).

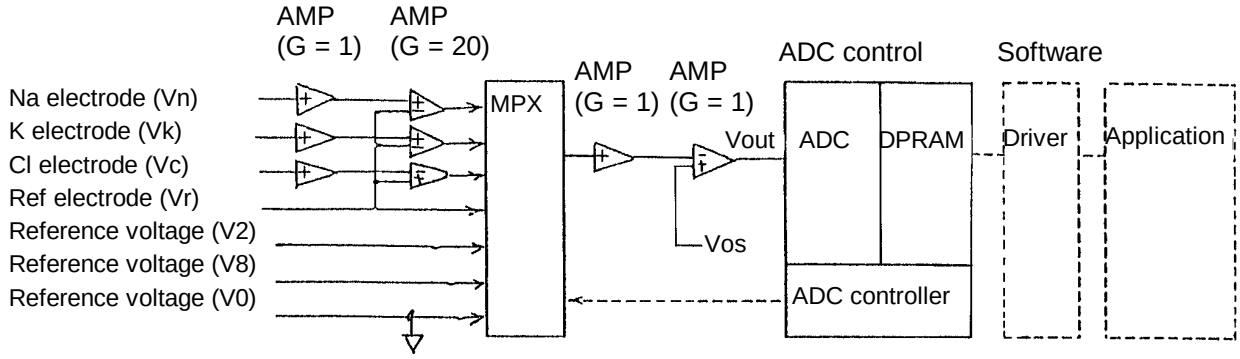
(4) Mechanical Operation when Reagent is Short

Reagent Short	ISE Diluent Aspiration	Internal Standard Solution Aspiration	Sipper Aspiration	Data Output
ISE diluent	× *	O	×	×
Internal standard solution	—	× *	×	×

* Aspiration/discharge is conducted if a liquid level sensor is provided.

5.3 Configuration of ISE Hardware

ISE Hardware Configuration



(1) The ADC controller converts the analog values of the ISE electrodes and reference voltages (V2/V8/V0) to digital ones upon receiving an instruction from the application via the driver and stores the digital values into the DPRAM (dual port RAM). The values are taken into the application via the driver.

(2) The application accesses the driver, but does not control the ADC directly.

(3) ADC input value Vout is as follows.

(a) When MPX selects Na electrode $Vout = -20 \times (Vn - Vr) + Vos$ [mV]

(b) When MPX selects K electrode $Vout = -20 \times (Vk - Vr) + Vos$ [mV]

(c) When MPX selects Cl electrode $Vout = 20 \times (Vcl - Vr) + Vos$ [mV]

(d) When MPX selects Ref electrode $Vout = -Vr + Vos$ [mV]

(e) When MPX selects reference voltage (V2) $Vout = 2{,}000 \pm 5$ [mV]

(f) When MPX selects reference voltage (V8) $Vout = 8{,}000 \pm 5$ [mV]

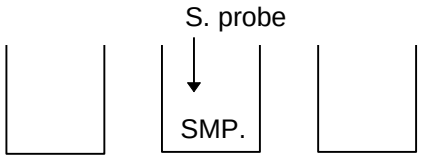
(g) When MPX selects reference voltage (V0) $Vout = Vos$ [mV]

NOTES:
1. The unit is mV.
2. Each AMP offset voltage is included in Vos.
3. With the 902, Vos is 110 mV.

5.4 ISE Measurement Sequence

For the dilution bath in ISE measurement, be sure to use two connected reaction cuvettes.

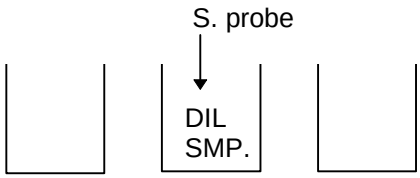
(1) Sample Pipetting



Cuvette no.	n + 2	n + 1	n
Cycle no.	11	12	13
Stop no.	1	1	1

Sample pipetting volume: Fixed at 10 µL

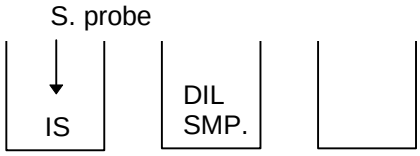
(2) Diluent Pipetting + Water + Stirring



Cuvette no.	n + 2	n + 1	n
Cycle no.	11	12	13
Stop no.	3	3	3

Diluent pipetting volume : Fixed at 308 µL
Water : Fixed at 182 µL
Total 490 µL

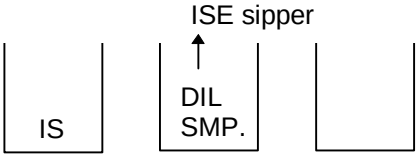
(3) Internal Standard Solution Pipetting + Water + Stirring



Cuvette no.	n + 2	n + 1	n
Cycle no.	12	13	14
Stop no.	3	3	3

Internal standard solution pipetting volum : Fixed at 318 µL
Water : Fixed at 182 µL
Total 500 µL

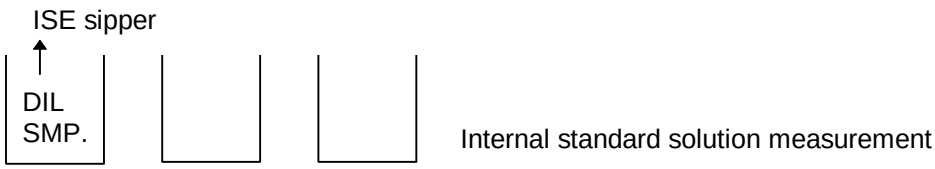
(4) Sample Aspiration



Cuvette no.	n + 2	n + 1	n
Cycle no.	17	18	19
Stop no.	1	1	1

Sample measurement

(5) Internal Standard Solution Aspiration



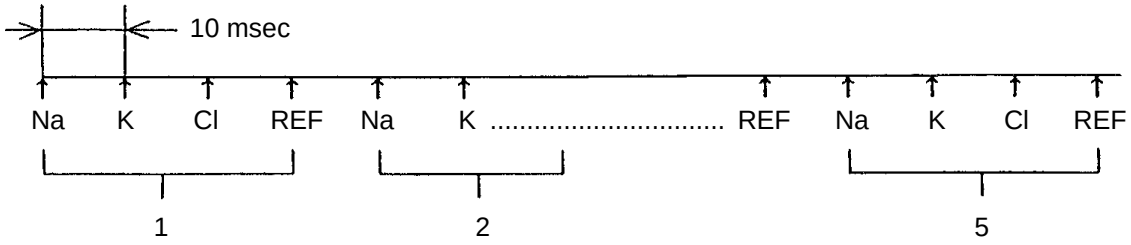
Cuvette no.	n + 2	n + 1	n
Cycle no.	18	19	20
Stop no.	1	1	1

---

* Electrode conditioning is carried out when 2 hours or 24 hours have elapsed after ISE measurement. Two cells are used for the conditioning and internal standard solution is aspirated.

5.5 ISE A/D Conversion

(1) ISE A/D Conversion Timing



(a) As shown in the above figure, measure the electromotive force 5 times each for Na, K and Cl in this order.

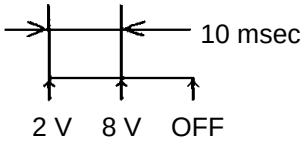
(b) The A/D conversion interval time for each is 10 msec.

(c) ADC alarm is issued if the ADC count, even once, is 0.

(2) ADC Setting Parameters

- Number of integrations : 8
- Software trigger interval : 10 msec

(3) ISE ADC Calibration Timing



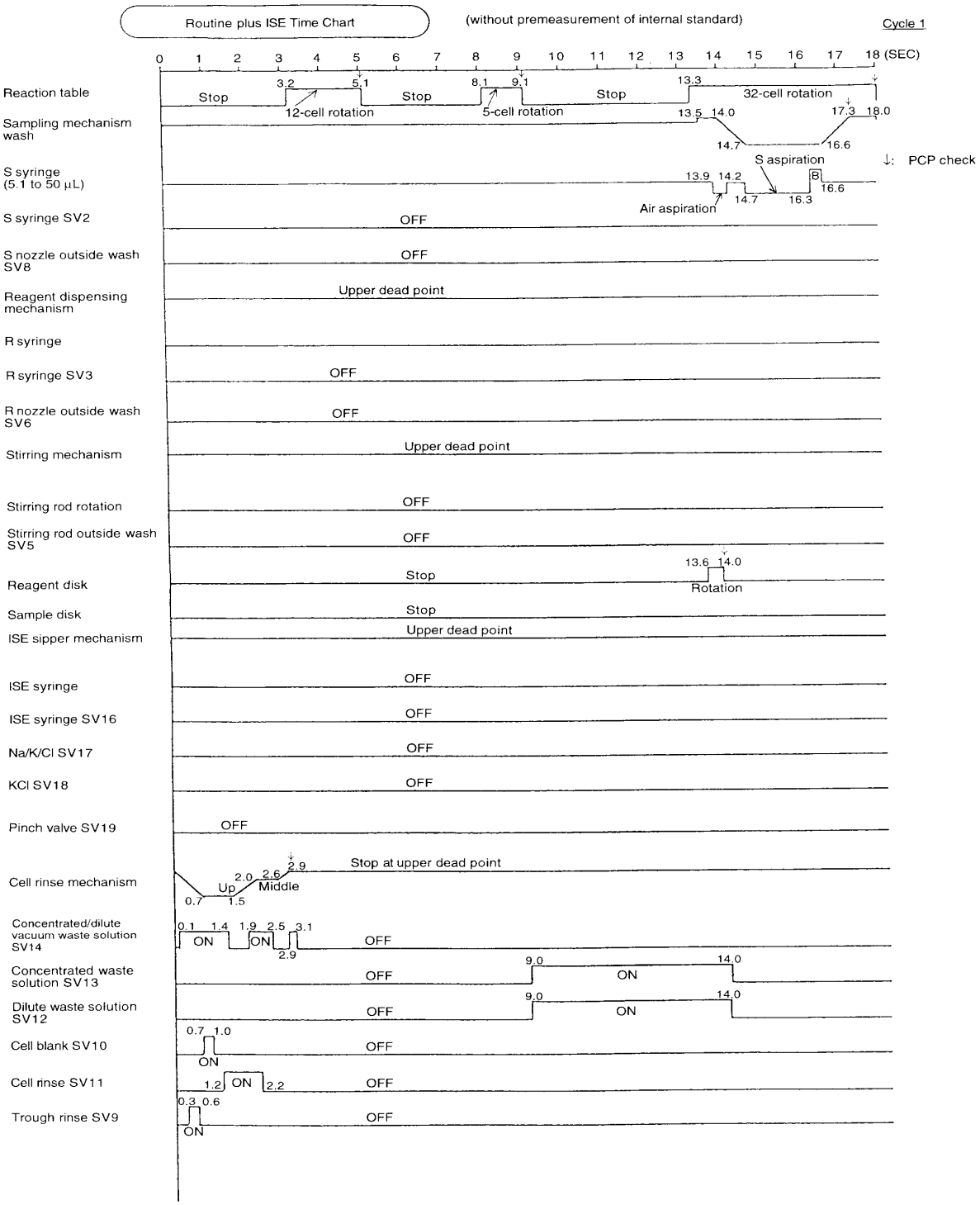
(a) As shown in the above figure, measure the reference voltages (2 V, 8 V and offset voltage).

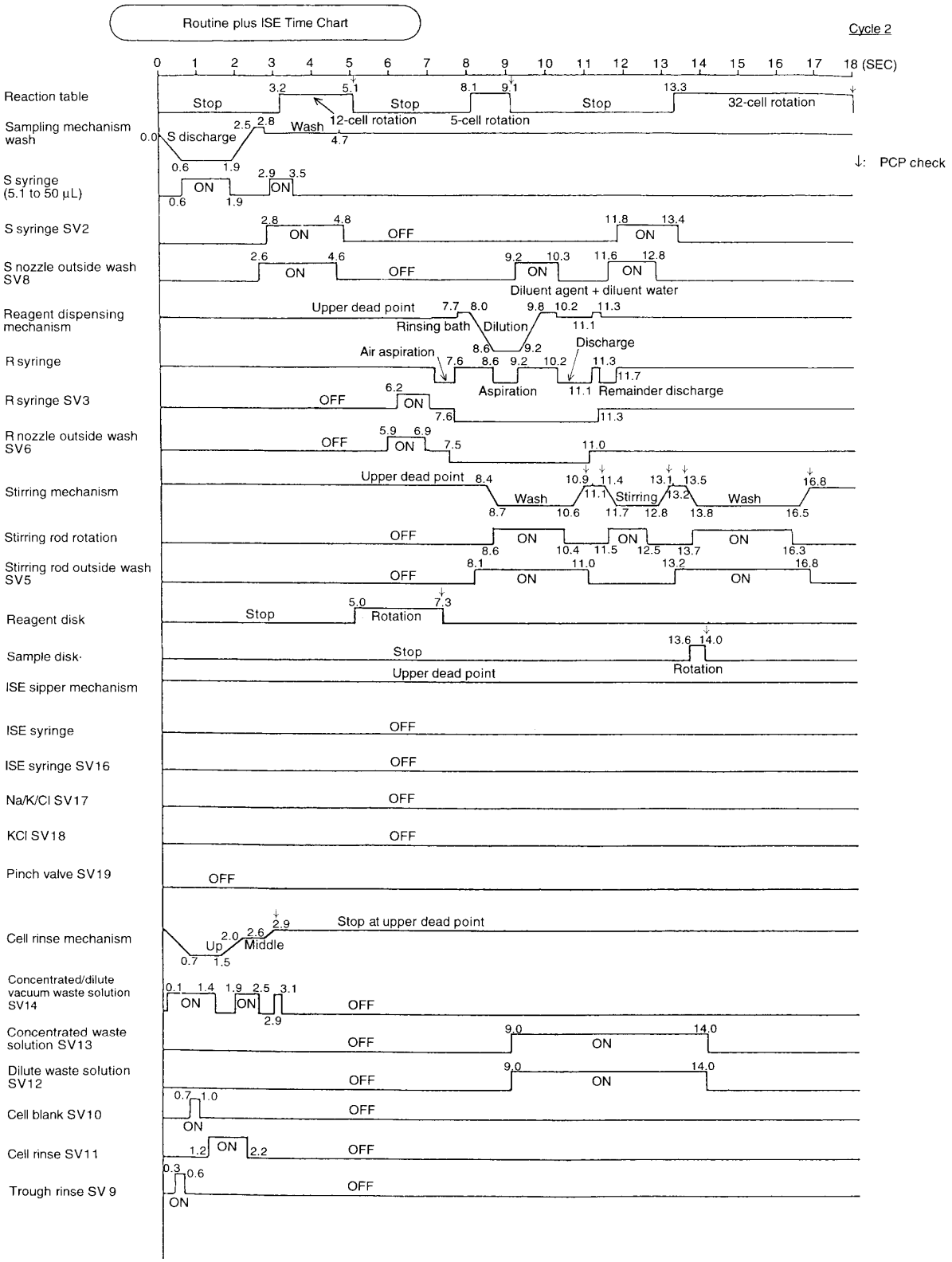
(b) The A/D conversion interval time for each is 10 msec.

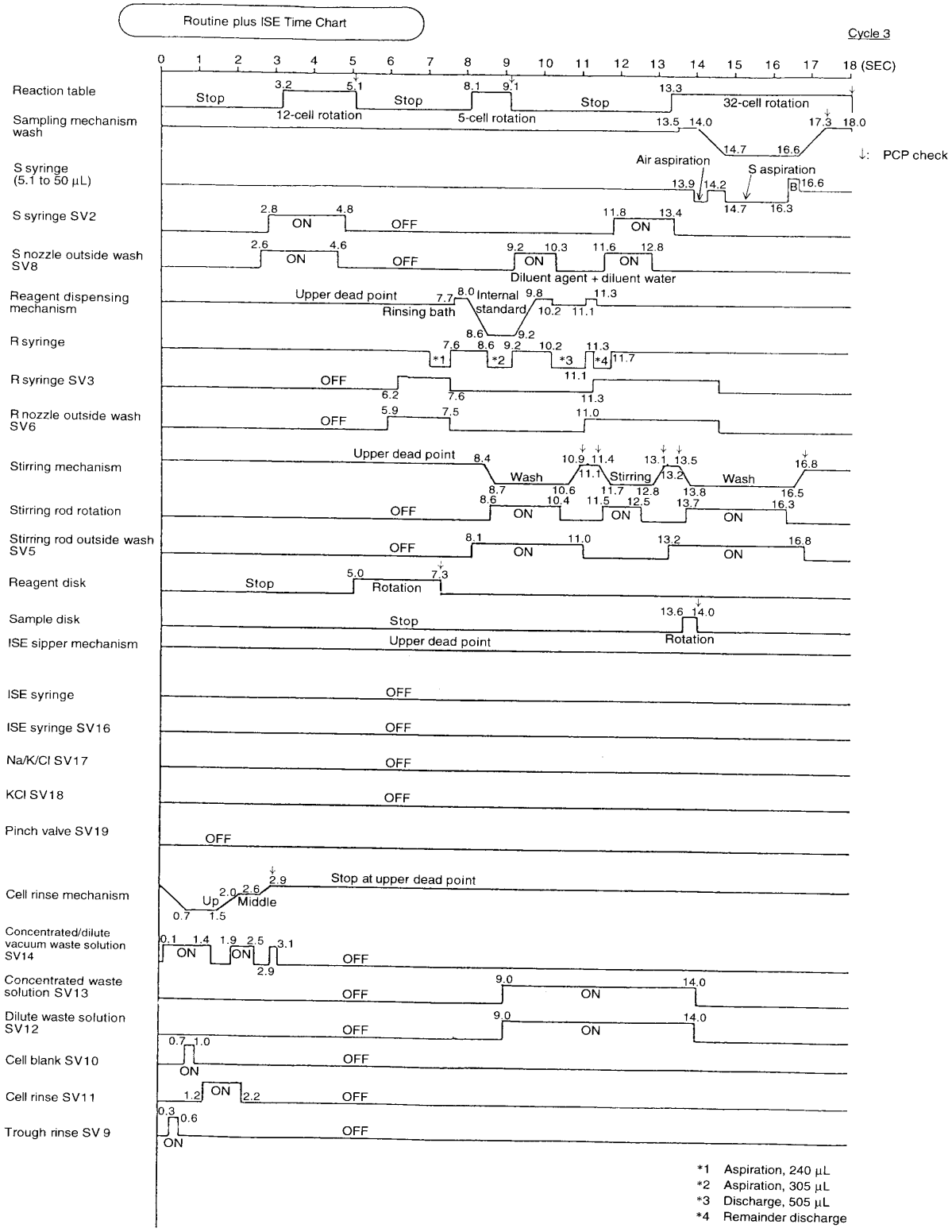
(c) At the time of initialization and T/M resetting, the RESET command is issued for the ADC controller.

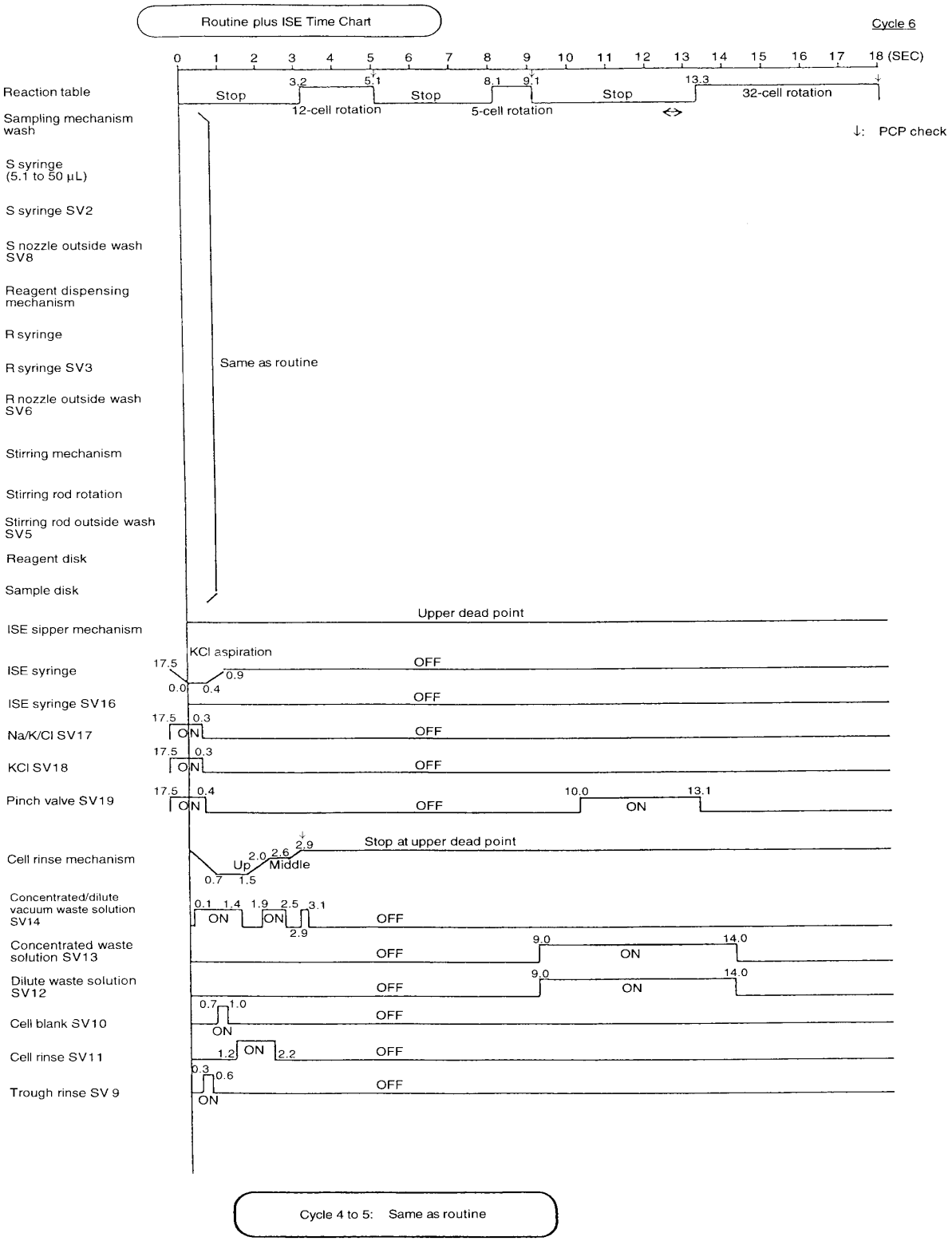
(d) Number of integrations (1 time) = 8

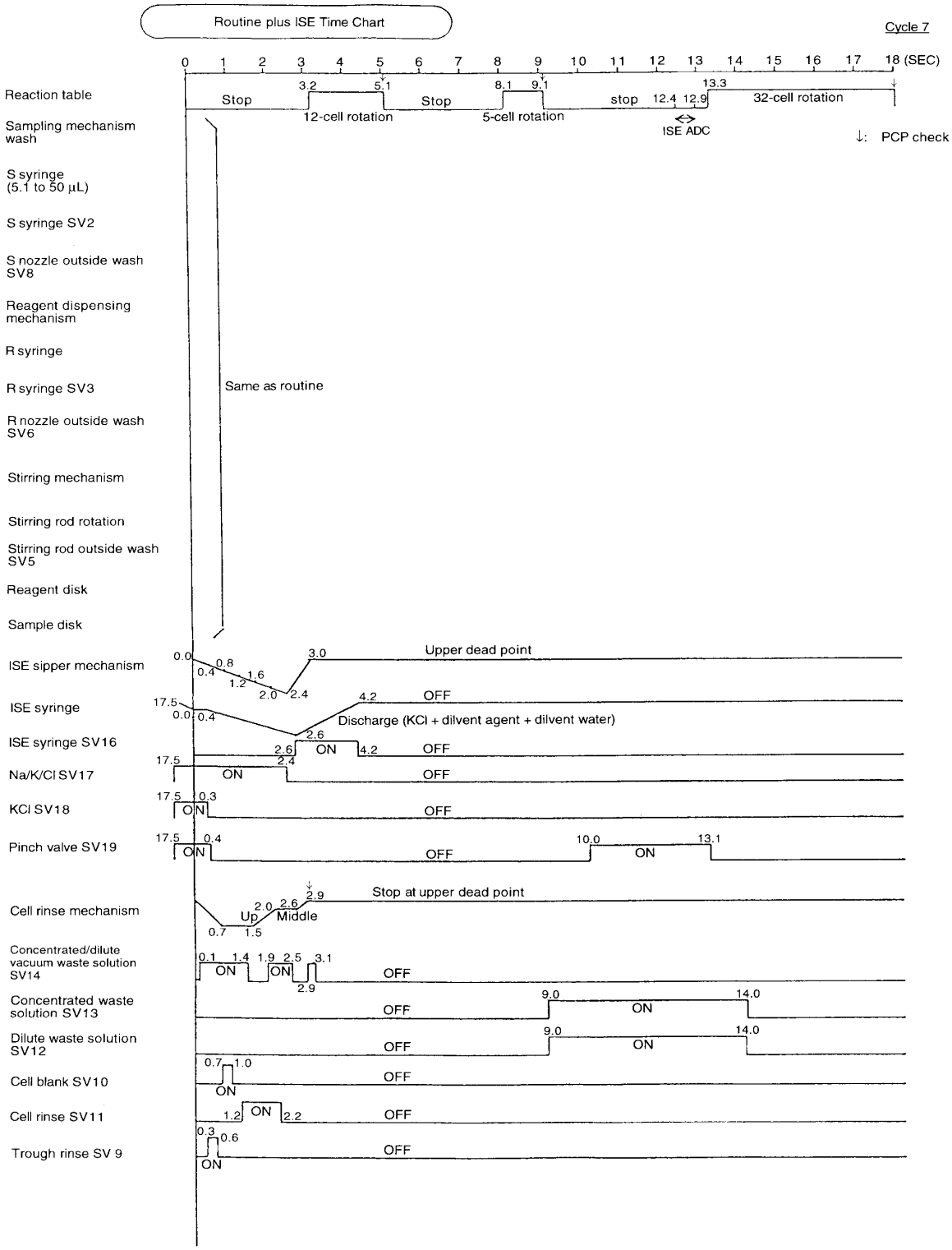
5.7 Time Chart

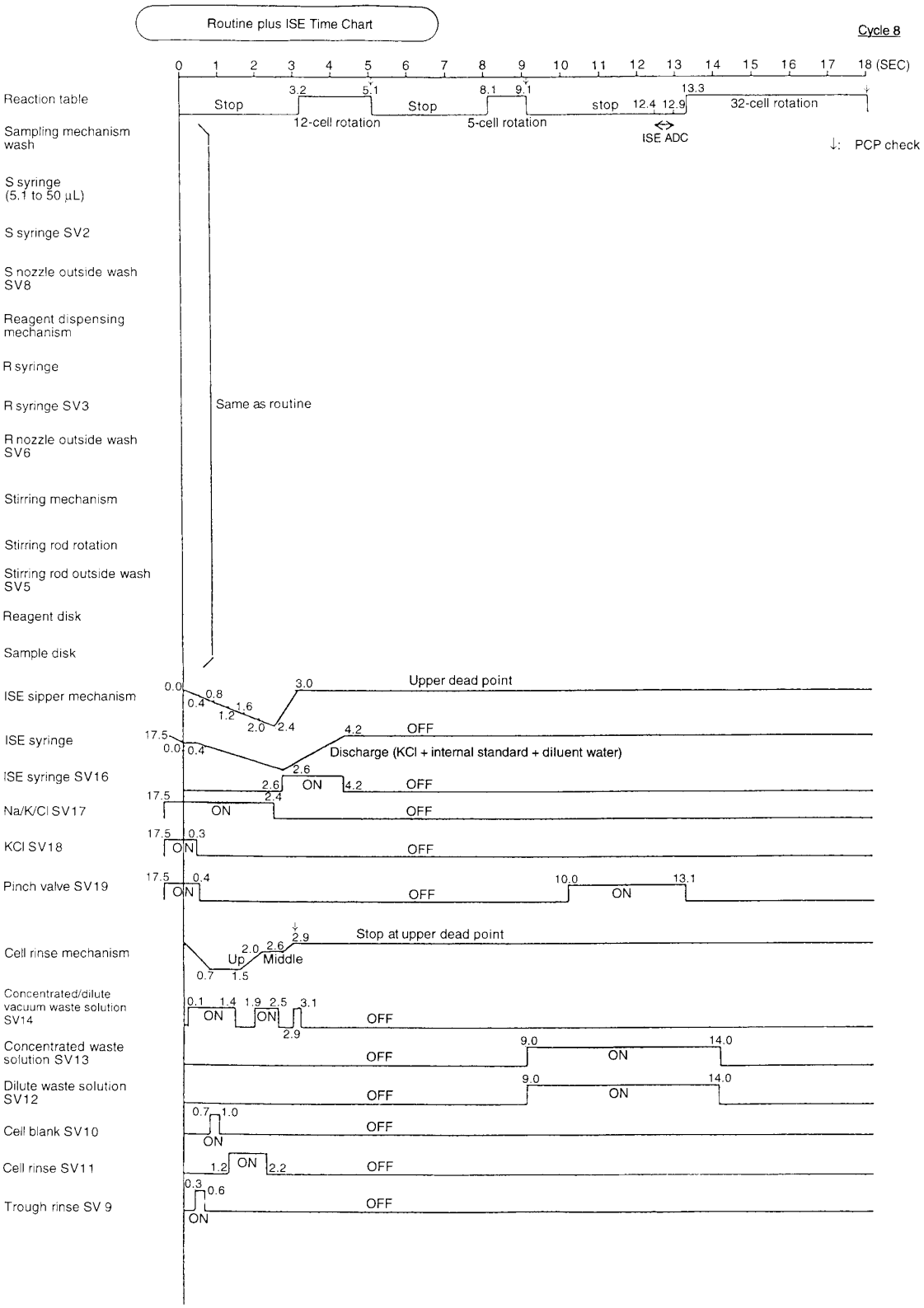


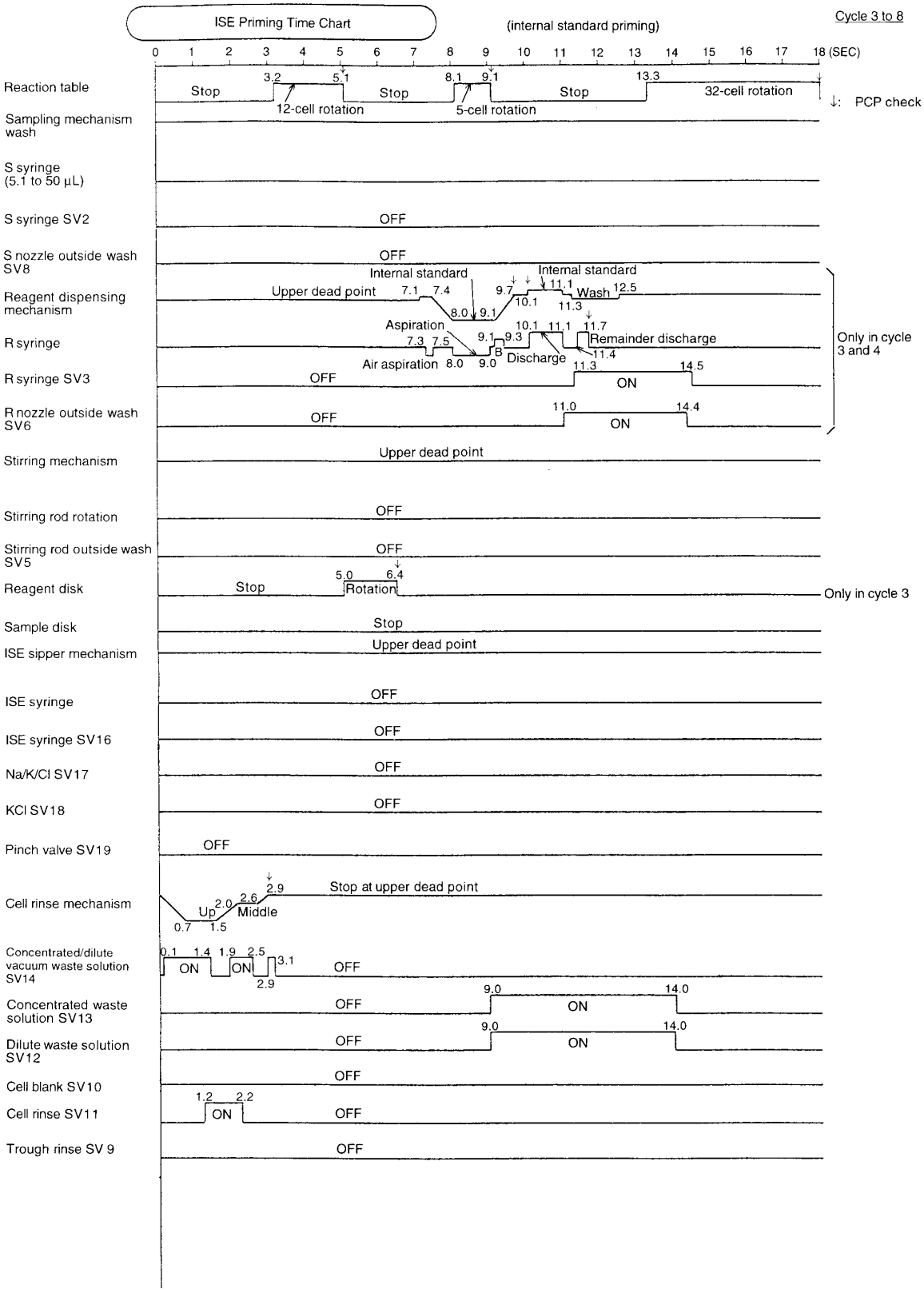

Routine plus ISE Time Chart
Cycle 2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
12-cell rotation
5-cell rotation
32-cell rotation
Sampling mechanism wash
S discharge
Wash
↓: PCP check
S syringe (5.1 to 50 µL)
ON
S syringe SV2
OFF
S nozzle outside wash SV8
Diluent agent + diluent water
Reagent dispensing mechanism
Upper dead point
Rinsing bath
Dilution
R syringe
Air aspiration
Discharge
Aspiration
Remainder discharge
R syringe SV3
R nozzle outside wash SV6
Stirring mechanism
Wash
Stirring
Stirring rod rotation
Stirring rod outside wash SV5
Reagent disk
Rotation
Sample disk
Stop at upper dead point
ISE sipper mechanism
ISE syringe
ISE syringe SV16
Na/K/Cl SV17
KCl SV18
Pinch valve SV19
Cell rinse mechanism
Up
Middle
Concentrated/dilute vacuum waste solution SV14
Concentrated waste solution SV13
Dilute waste solution SV12
Cell blank SV10
Cell rinse SV11
Trough rinse SV 9

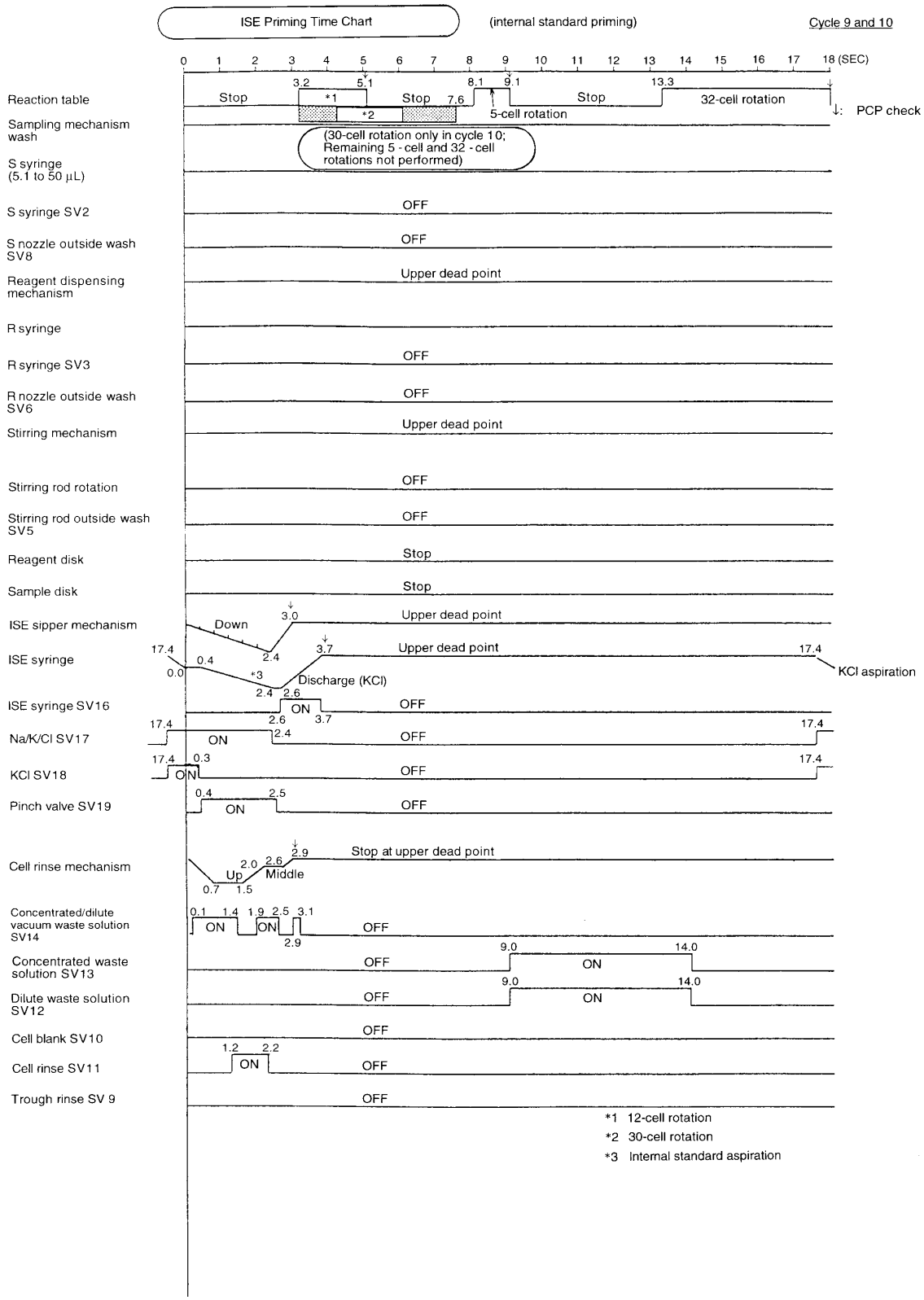

Routine plus ISE Time Chart
Cycle 3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
12-cell rotation
Stop
5-cell rotation
Stop
32-cell rotation
Sampling mechanism wash
S syringe (5.1 to 50 µL)
Air aspiration
S aspiration
↓: PCP check
S syringe SV2
ON
OFF
ON
S nozzle outside wash SV8
ON
OFF
ON
ON
Diluent agent + diluent water
Reagent dispensing mechanism
Upper dead point
Rinsing bath
Internal standard
R syringe
*1
*2
*3
*4
R syringe SV3
OFF
R nozzle outside wash SV6
OFF
Stirring mechanism
Upper dead point
Wash
Stirring
Wash
Stirring rod rotation
OFF
ON
ON
ON
Stirring rod outside wash SV5
OFF
ON
ON
Reagent disk
Stop
Rotation
Sample disk
Stop
Rotation
ISE sipper mechanism
Upper dead point
ISE syringe
OFF
ISE syringe SV16
OFF
Na/K/Cl SV17
OFF
KCl SV18
OFF
Pinch valve SV19
OFF
Cell rinse mechanism
Stop at upper dead point
Up
Middle
Concentrated/dilute vacuum waste solution SV14
ON
ON
OFF
Concentrated waste solution SV13
OFF
ON
Dilute waste solution SV12
OFF
ON
Cell blank SV10
ON
OFF
Cell rinse SV11
ON
OFF
Trough rinse SV 9
ON
OFF
*1 Aspiration, 240 µL
*2 Aspiration, 305 µL
*3 Discharge, 505 µL
*4 Remainder discharge

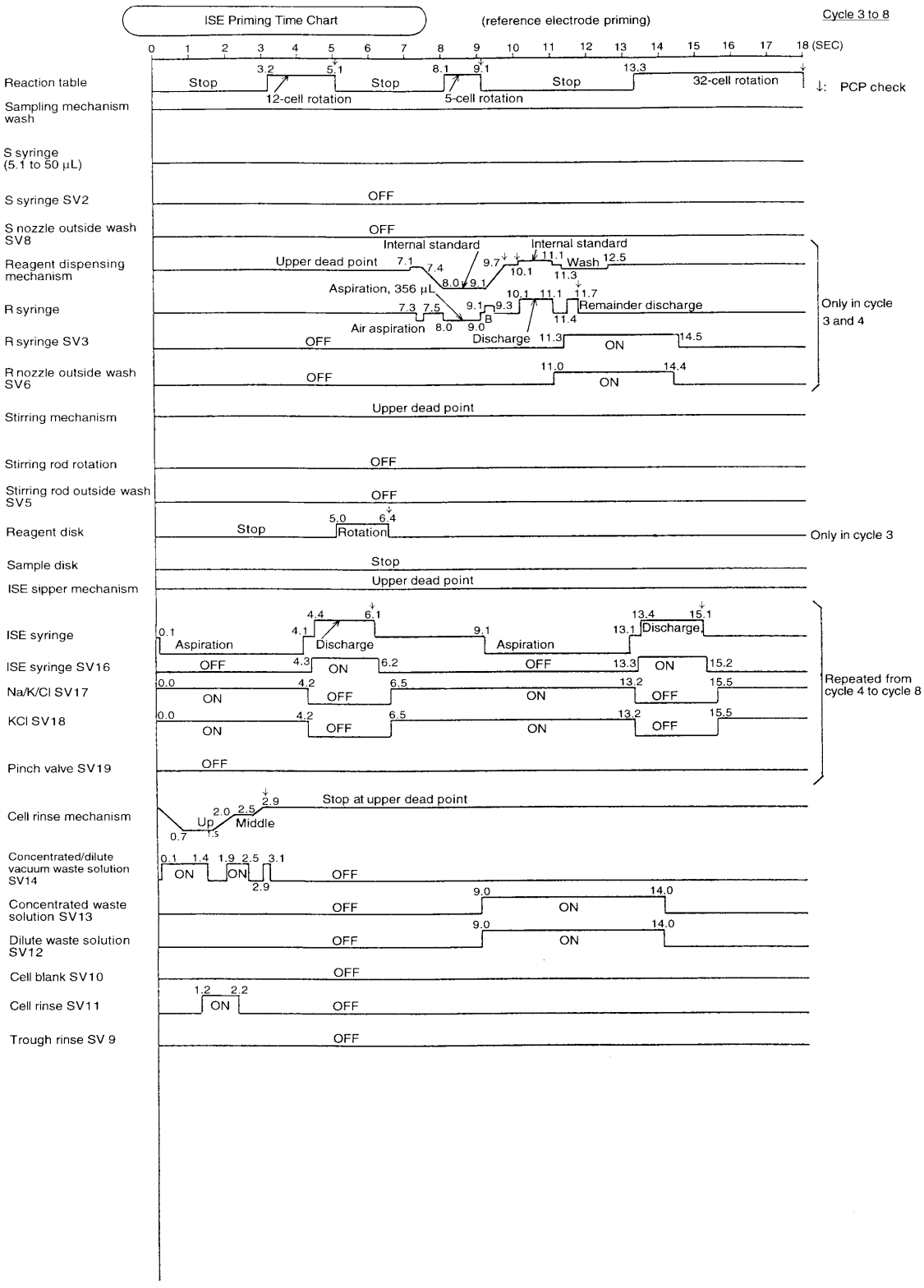

Routine plus ISE Time Chart
Cycle 6
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
12-cell rotation
Stop
5-cell rotation
Stop
32-cell rotation
↓: PCP check
Sampling mechanism wash
S syringe (5.1 to 50 µL)
S syringe SV2
S nozzle outside wash SV8
Reagent dispensing mechanism
R syringe
R syringe SV3
R nozzle outside wash SV6
Same as routine
Stirring mechanism
Stirring rod rotation
Stirring rod outside wash SV5
Reagent disk
Sample disk
ISE sipper mechanism
Upper dead point
ISE syringe
KCl aspiration
OFF
ISE syringe SV16
OFF
Na/K/Cl SV17
ON
OFF
KCl SV18
ON
OFF
Pinch valve SV19
ON
OFF
ON
Cell rinse mechanism
Stop at upper dead point
Up
Middle
Concentrated/dilute vacuum waste solution SV14
ON
ON
OFF
Concentrated waste solution SV13
OFF
ON
Dilute waste solution SV12
OFF
ON
Cell blank SV10
ON
OFF
Cell rinse SV11
ON
OFF
Trough rinse SV 9
ON
OFF
Cycle 4 to 5: Same as routine

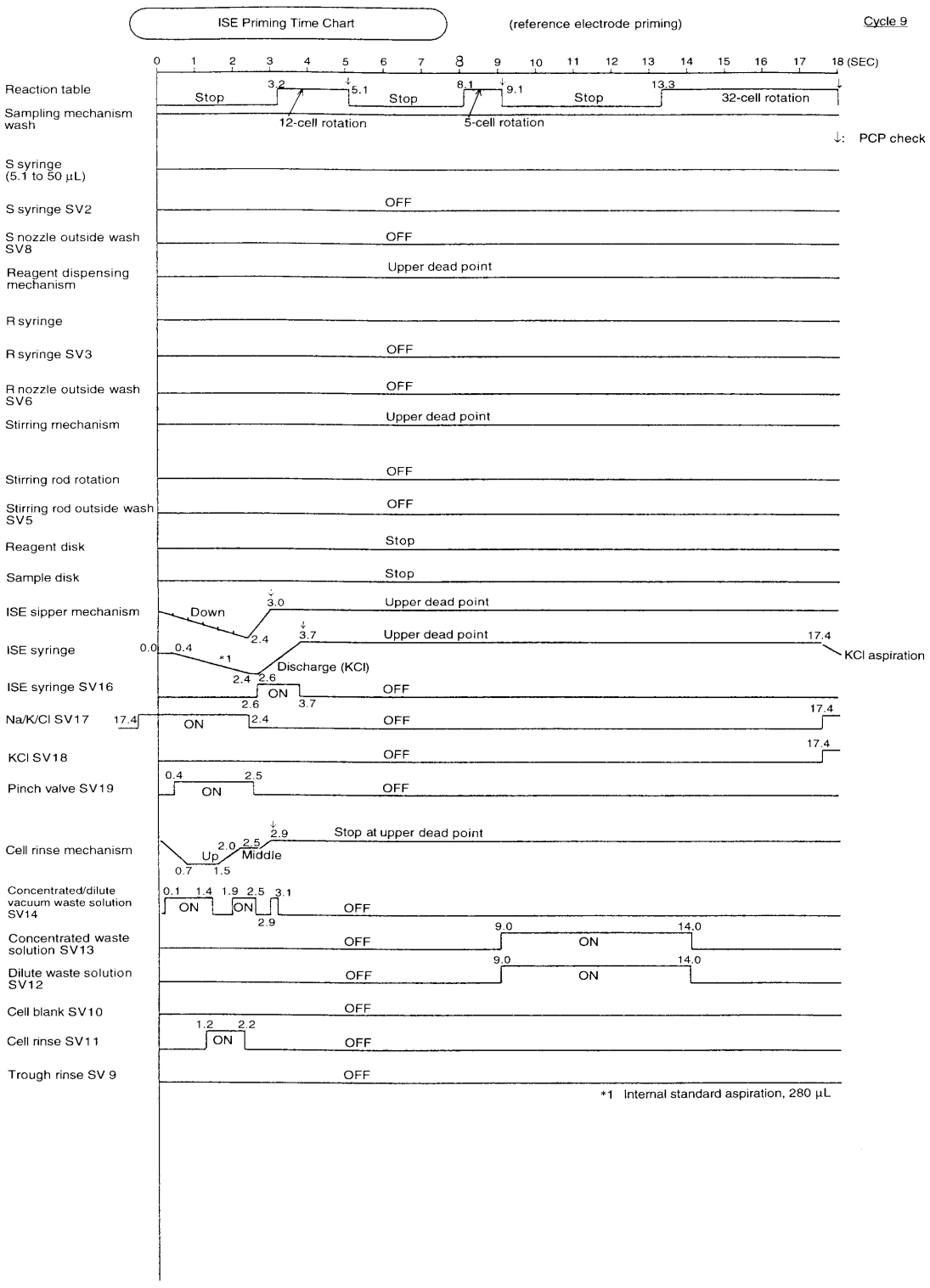

Routine plus ISE Time Chart
Cycle 7
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
12-cell rotation
Stop
5-cell rotation
stop
ISE ADC
32-cell rotation
↓: PCP check
Sampling mechanism wash
S syringe (5.1 to 50 µL)
S syringe SV2
S nozzle outside wash SV8
Reagent dispensing mechanism
R syringe
R syringe SV3
Same as routine
R nozzle outside wash SV6
Stirring mechanism
Stirring rod rotation
Stirring rod outside wash SV5
Reagent disk
Sample disk
ISE sipper mechanism
Upper dead point
ISE syringe
OFF
Discharge (KCl + dilvent agent + dilvent water)
ISE syringe SV16
ON
OFF
Na/K/Cl SV17
ON
OFF
KCl SV18
ON
OFF
Pinch valve SV19
ON
OFF
ON
Cell rinse mechanism
Stop at upper dead point
Up
Middle
Concentrated/dilute vacuum waste solution SV14
ON
ON
OFF
Concentrated waste solution SV13
OFF
ON
Dilute waste solution SV12
OFF
ON
Cell blank SV10
ON
OFF
Cell rinse SV11
ON
OFF
Trough rinse SV 9
ON
OFF

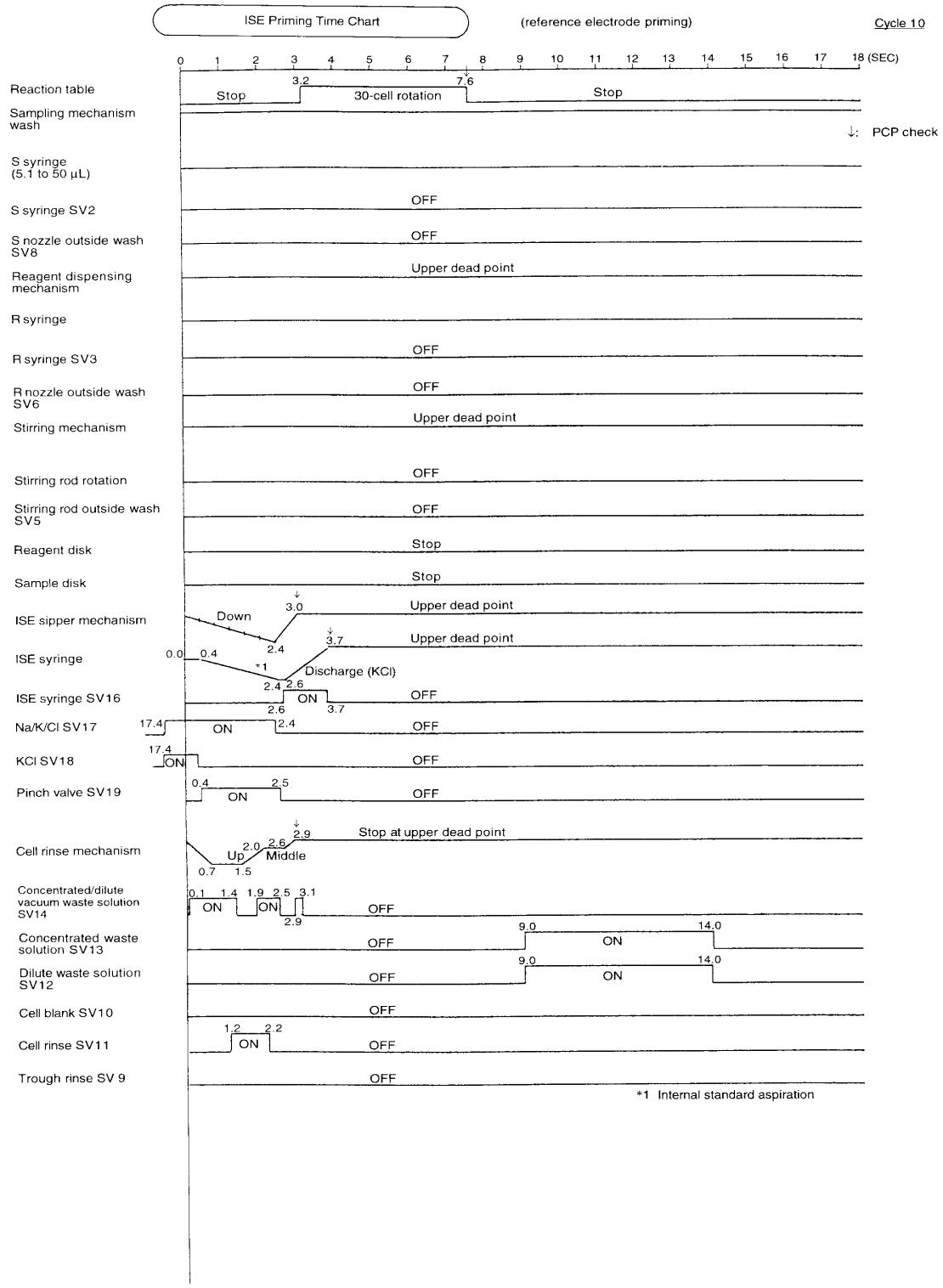

Routine plus ISE Time Chart
Cycle 8
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
3.2
5.1
12-cell rotation
Stop
8.1
9.1
5-cell rotation
stop
12.4
12.9
ISE ADC
13.3
32-cell rotation
↓: PCP check
Sampling mechanism wash
S syringe (5.1 to 50 µL)
S syringe SV2
S nozzle outside wash SV8
Reagent dispensing mechanism
R syringe
R syringe SV3
R nozzle outside wash SV6
Stirring mechanism
Stirring rod rotation
Stirring rod outside wash SV5
Reagent disk
Sample disk
Same as routine
ISE sipper mechanism
0.0 0.4 0.8 1.2 1.6 2.0 2.4 3.0
Upper dead point
ISE syringe
17.5 0.0 0.4
Discharge (KCl + internal standard + diluent water)
4.2 OFF
ISE syringe SV16
2.6 ON 4.2 OFF
Na/K/Cl SV17
17.5 2.4 ON OFF
KCl SV18
17.5 0.3 ON OFF
Pinch valve SV19
17.5 0.4 ON OFF 10.0 ON 13.1
Cell rinse mechanism
2.9
Stop at upper dead point
Up 2.0 2.6 Middle
0.7 1.5
Concentrated/dilute vacuum waste solution SV14
0.1 ON 1.4 1.9 ON 2.5 3.1 2.9 OFF
Concentrated waste solution SV13
OFF 9.0 ON 14.0
Dilute waste solution SV12
OFF 9.0 ON 14.0
Cell blank SV10
0.7 ON 1.0 OFF
Cell rinse SV11
1.2 ON 2.2 OFF
Trough rinse SV 9
0.3 ON 0.6 OFF

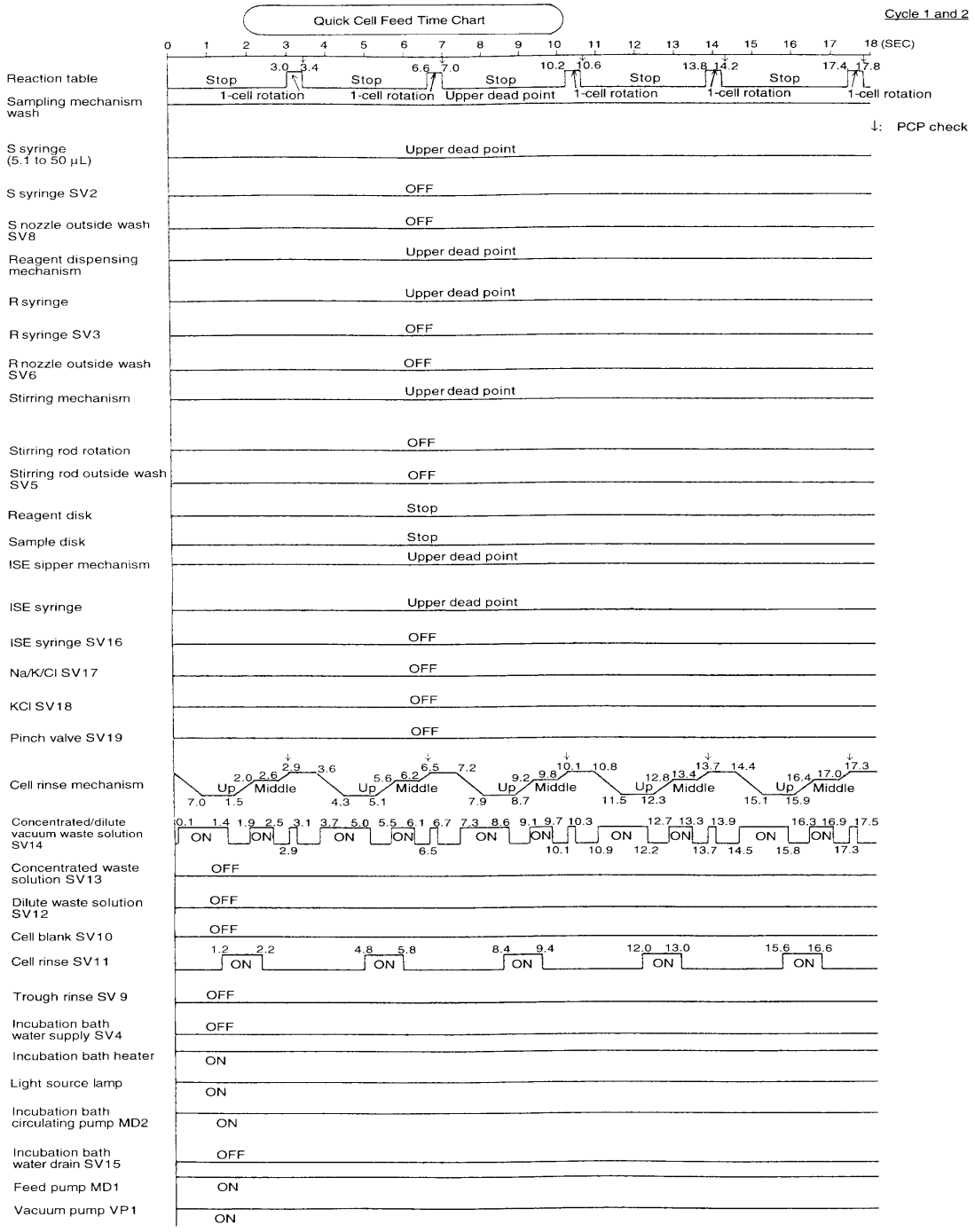

ISE Priming Time Chart
(internal standard priming)
Cycle 3 to 8
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
12-cell rotation
Stop
5-cell rotation
Stop
32-cell rotation
↓: PCP check
Sampling mechanism wash
S syringe (5.1 to 50 µL)
S syringe SV2
OFF
S nozzle outside wash SV8
OFF
Reagent dispensing mechanism
Internal standard
Upper dead point
Aspiration
Air aspiration
Discharge
Wash
Internal standard
Remainder discharge
R syringe
R syringe SV3
OFF
ON
R nozzle outside wash SV6
OFF
ON
Only in cycle 3 and 4
Stirring mechanism
Upper dead point
Stirring rod rotation
OFF
Stirring rod outside wash SV5
OFF
Reagent disk
Stop
Rotation
Only in cycle 3
Sample disk
Stop
ISE sipper mechanism
Upper dead point
ISE syringe
OFF
ISE syringe SV16
OFF
Na/K/Cl SV17
OFF
KCl SV18
OFF
Pinch valve SV19
OFF
Cell rinse mechanism
Stop at upper dead point
Up
Middle
Concentrated/dilute vacuum waste solution SV14
ON
ON
OFF
Concentrated waste solution SV13
OFF
ON
Dilute waste solution SV12
OFF
ON
Cell blank SV10
OFF
Cell rinse SV11
ON
OFF
Trough rinse SV 9
OFF

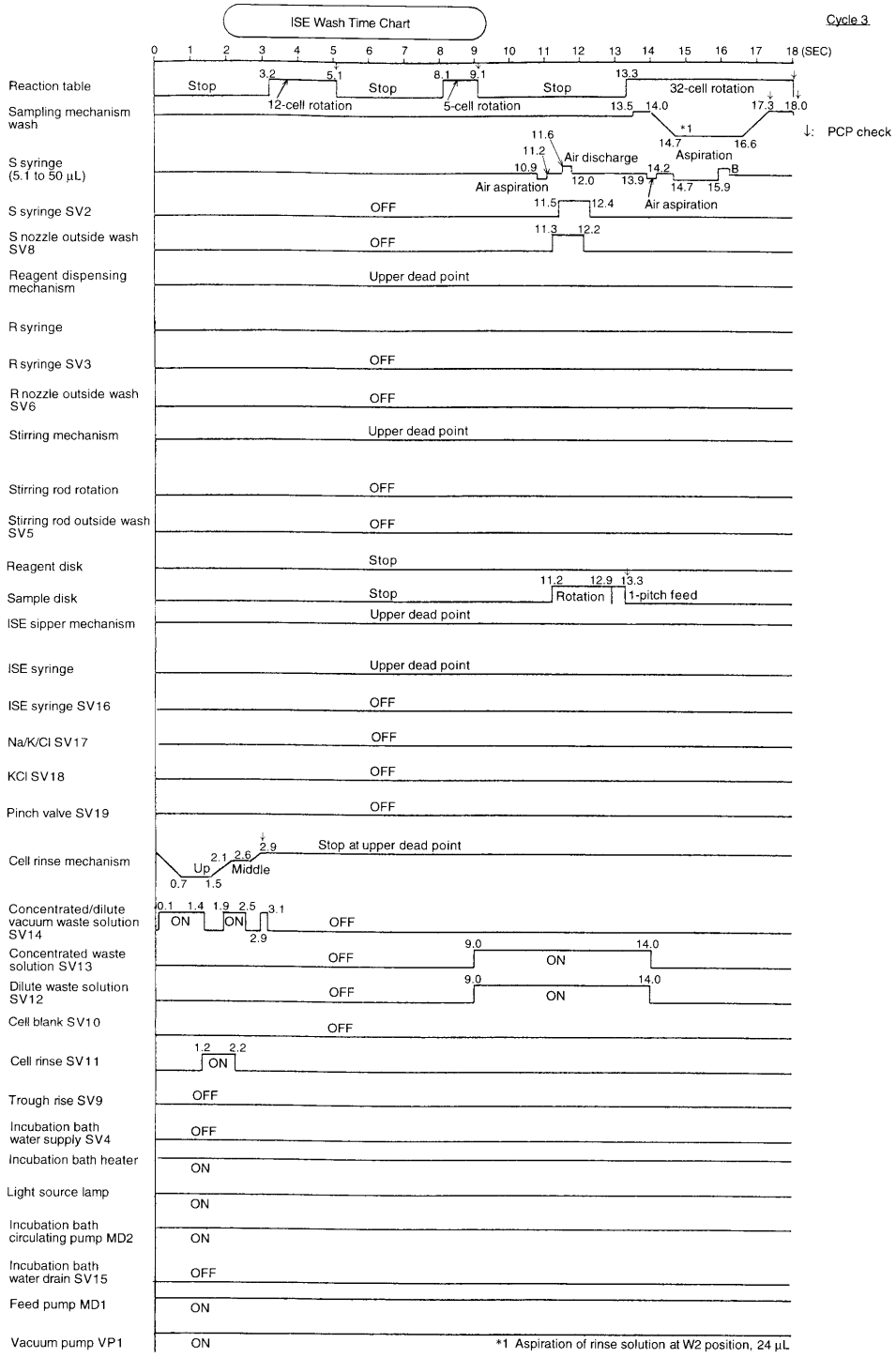

ISE Priming Time Chart
(internal standard priming)
Cycle 9 and 10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
3.2
*1
5.1
Stop
7.6
8.1
9.1
Stop
13.3
32-cell rotation
*2
5-cell rotation
↓: PCP check
Sampling mechanism wash
(30-cell rotation only in cycle 10; Remaining 5 - cell and 32 - cell rotations not performed)
S syringe (5.1 to 50 µL)
S syringe SV2
OFF
S nozzle outside wash SV8
OFF
Reagent dispensing mechanism
Upper dead point
R syringe
R syringe SV3
OFF
R nozzle outside wash SV6
OFF
Stirring mechanism
Upper dead point
Stirring rod rotation
OFF
Stirring rod outside wash SV5
OFF
Reagent disk
Stop
Sample disk
Stop
ISE sipper mechanism
Down
3.0
Upper dead point
ISE syringe
17.4
0.0
0.4
*3
2.4
3.7
Upper dead point
Discharge (KCl)
17.4
KCl aspiration
ISE syringe SV16
2.4
2.6
ON
OFF
2.6
3.7
Na/K/Cl SV17
17.4
ON
2.4
OFF
17.4
KCl SV18
17.4
0.3
ON
OFF
17.4
Pinch valve SV19
0.4
2.5
ON
OFF
Cell rinse mechanism
2.9
Stop at upper dead point
2.0
2.6
Up
Middle
0.7
1.5
Concentrated/dilute vacuum waste solution SV14
0.1
1.4
1.9
2.5
3.1
ON
ON
OFF
2.9
Concentrated waste solution SV13
OFF
9.0
ON
14.0
Dilute waste solution SV12
OFF
9.0
ON
14.0
Cell blank SV10
OFF
Cell rinse SV11
1.2
2.2
ON
OFF
Trough rinse SV 9
OFF
*1 12-cell rotation
*2 30-cell rotation
*3 Internal standard aspiration

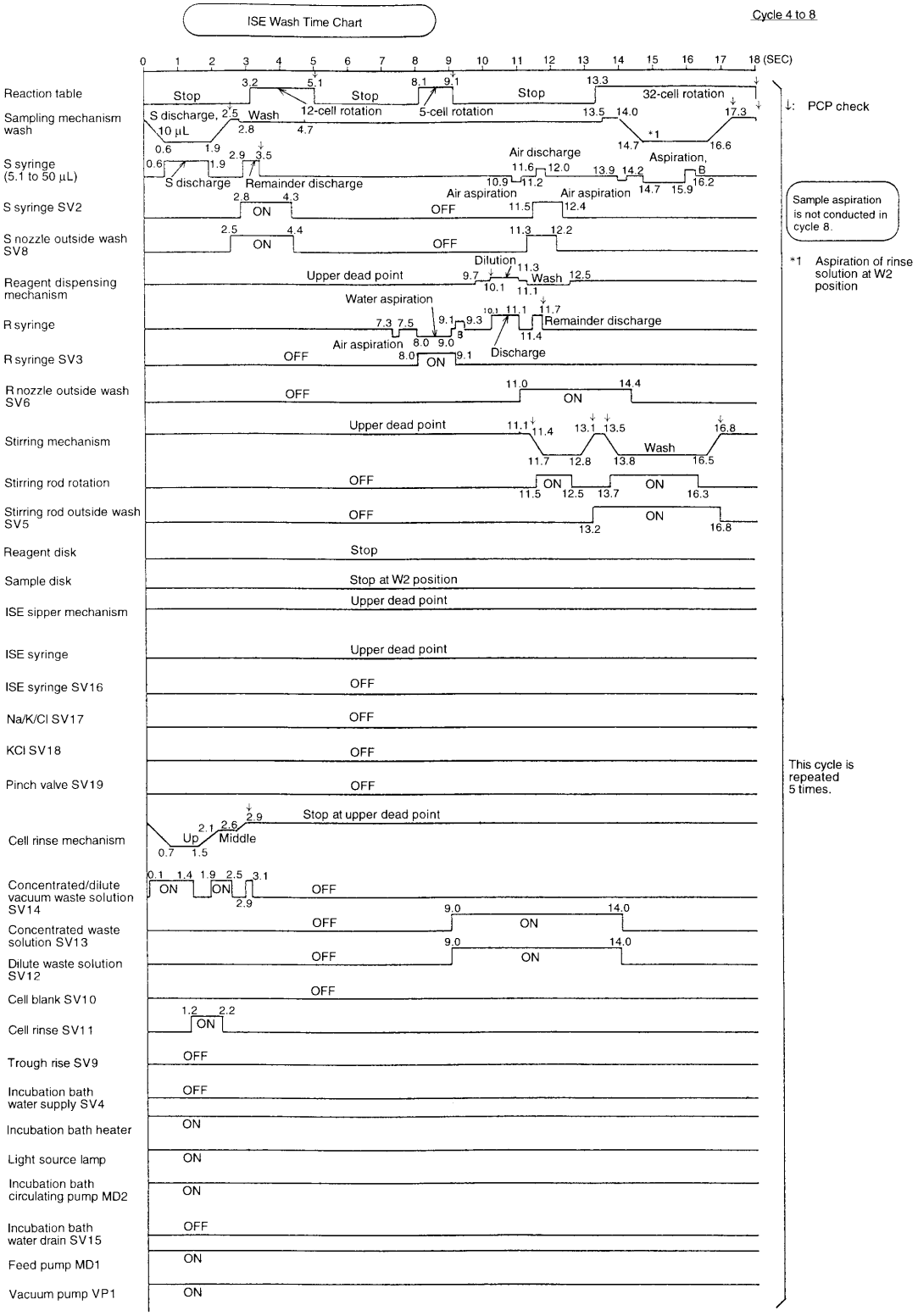

ISE Priming Time Chart
(reference electrode priming)
Cycle 3 to 8
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
12-cell rotation
Stop
5-cell rotation
Stop
32-cell rotation
↓: PCP check
Sampling mechanism wash
S syringe (5.1 to 50 µL)
S syringe SV2
OFF
S nozzle outside wash SV8
OFF
Reagent dispensing mechanism
Internal standard
Upper dead point
Aspiration, 356 µL
Internal standard
Wash
R syringe
Air aspiration
Discharge
Remainder discharge
Only in cycle 3 and 4
R syringe SV3
OFF
ON
R nozzle outside wash SV6
OFF
ON
Stirring mechanism
Upper dead point
Stirring rod rotation
OFF
Stirring rod outside wash SV5
OFF
Reagent disk
Stop
Rotation
Only in cycle 3
Sample disk
Stop
ISE sipper mechanism
Upper dead point
ISE syringe
Aspiration
Discharge
Aspiration
Discharge
ISE syringe SV16
OFF
ON
OFF
ON
Na/K/Cl SV17
ON
OFF
ON
OFF
KCl SV18
ON
OFF
ON
OFF
Repeated from cycle 4 to cycle 8
Pinch valve SV19
OFF
Cell rinse mechanism
Up
Middle
Stop at upper dead point
Concentrated/dilute vacuum waste solution SV14
ON
ON
OFF
Concentrated waste solution SV13
OFF
ON
Dilute waste solution SV12
OFF
ON
Cell blank SV10
OFF
Cell rinse SV11
ON
OFF
Trough rinse SV 9
OFF

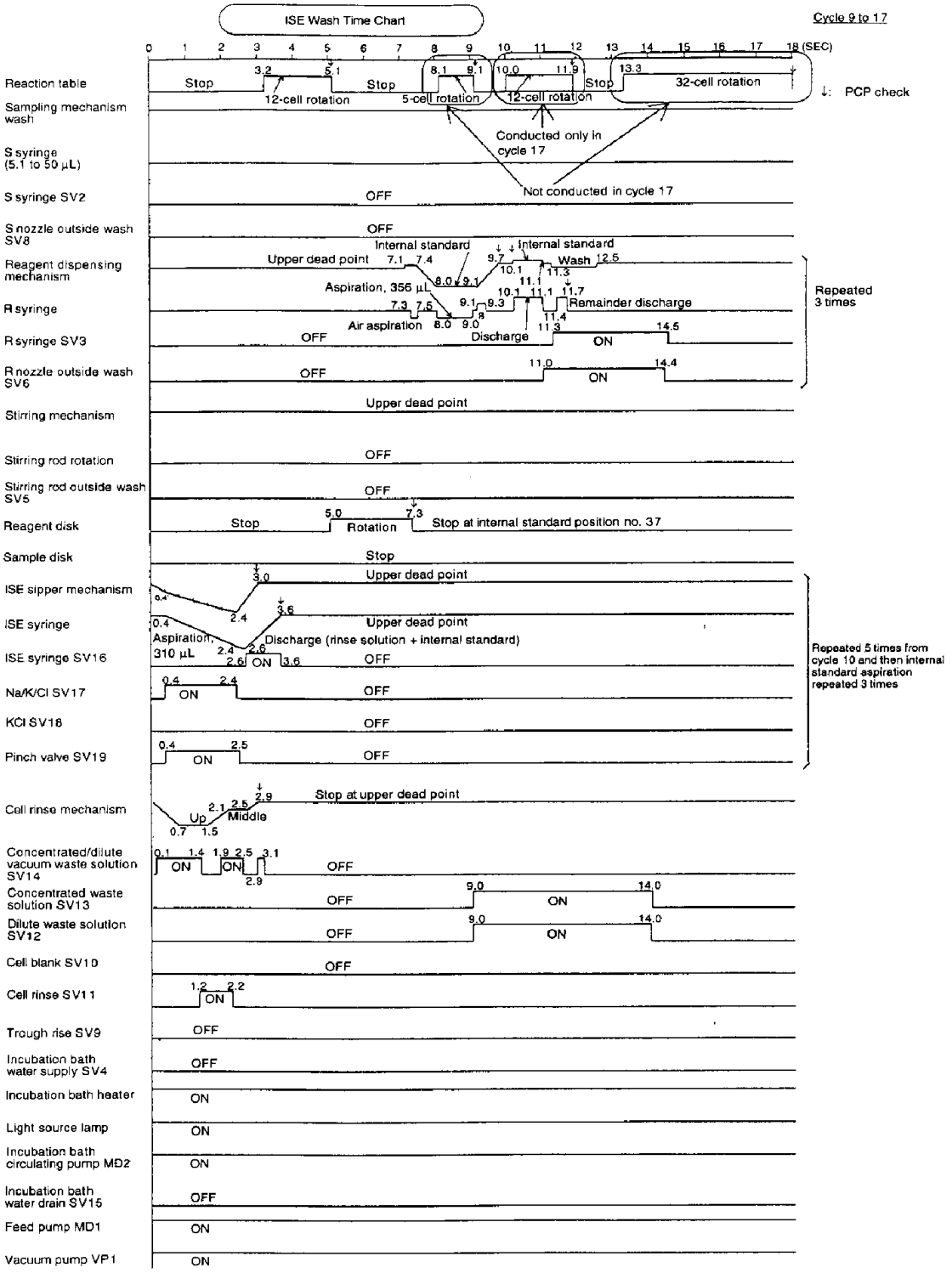

ISE Priming Time Chart
(reference electrode priming)
Cycle 9
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
3.2
5.1
Stop
8.1
9.1
Stop
13.3
32-cell rotation
Sampling mechanism wash
12-cell rotation
5-cell rotation
↓: PCP check
S syringe (5.1 to 50 µL)
S syringe SV2
OFF
S nozzle outside wash SV8
OFF
Reagent dispensing mechanism
Upper dead point
R syringe
R syringe SV3
OFF
R nozzle outside wash SV6
OFF
Stirring mechanism
Upper dead point
Stirring rod rotation
OFF
Stirring rod outside wash SV5
OFF
Reagent disk
Stop
Sample disk
Stop
ISE sipper mechanism
Down
3.0
2.4
Upper dead point
ISE syringe
0.0
0.4
*1
3.7
Upper dead point
17.4
KCl aspiration
Discharge (KCl)
2.4
2.6
ISE syringe SV16
2.6
ON
3.7
OFF
Na/K/Cl SV17
17.4
ON
2.4
OFF
17.4
KCl SV18
OFF
17.4
Pinch valve SV19
0.4
2.5
ON
OFF
Cell rinse mechanism
2.9
Stop at upper dead point
2.0
2.5
Up
Middle
0.7
1.5
Concentrated/dilute vacuum waste solution SV14
0.1
1.4
1.9
2.5
3.1
ON
ON
2.9
OFF
Concentrated waste solution SV13
OFF
9.0
ON
14.0
Dilute waste solution SV12
OFF
9.0
ON
14.0
Cell blank SV10
OFF
Cell rinse SV11
1.2
2.2
ON
OFF
Trough rinse SV 9
OFF
*1 Internal standard aspiration, 280 µL


ISE Priming Time Chart
(reference electrode priming)
Cycle 10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
3.2
30-cell rotation
7.6
Stop
Sampling mechanism wash
↓: PCP check
S syringe (5.1 to 50 µL)
S syringe SV2
OFF
S nozzle outside wash SV8
OFF
Reagent dispensing mechanism
Upper dead point
R syringe
R syringe SV3
OFF
R nozzle outside wash SV6
OFF
Stirring mechanism
Upper dead point
Stirring rod rotation
OFF
Stirring rod outside wash SV5
OFF
Reagent disk
Stop
Sample disk
Stop
ISE sipper mechanism
Down
3.0
2.4
Upper dead point
ISE syringe
0.0 0.4
*1
3.7
Upper dead point
Discharge (KCl)
2.4 2.6
ISE syringe SV16
2.6
ON
3.7
OFF
Na/K/Cl SV17
17.4
ON
2.4
OFF
KCl SV18
17.4
ON
OFF
Pinch valve SV19
0.4
2.5
ON
OFF
Cell rinse mechanism
2.9
Stop at upper dead point
2.0 2.6
Up
Middle
0.7 1.5
Concentrated/dilute vacuum waste solution SV14
0.1 1.4 1.9 2.5 3.1
ON
ON
2.9
OFF
Concentrated waste solution SV13
OFF
9.0
ON
14.0
Dilute waste solution SV12
OFF
9.0
ON
14.0
Cell blank SV10
OFF
Cell rinse SV11
1.2 2.2
ON
OFF
Trough rinse SV 9
OFF
*1 Internal standard aspiration


Quick Cell Feed Time Chart
Cycle 1 and 2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
1-cell rotation
Upper dead point
↓: PCP check
Sampling mechanism wash
S syringe (5.1 to 50 µL)
S syringe SV2
S nozzle outside wash SV8
Reagent dispensing mechanism
R syringe
R syringe SV3
R nozzle outside wash SV6
Stirring mechanism
Stirring rod rotation
Stirring rod outside wash SV5
Reagent disk
Sample disk
ISE sipper mechanism
ISE syringe
ISE syringe SV16
Na/K/Cl SV17
KCl SV18
Pinch valve SV19
Cell rinse mechanism
Up
Middle
Concentrated/dilute vacuum waste solution SV14
ON
Concentrated waste solution SV13
Dilute waste solution SV12
Cell blank SV10
Cell rinse SV11
Trough rinse SV 9
Incubation bath water supply SV4
Incubation bath heater
Light source lamp
Incubation bath circulating pump MD2
Incubation bath water drain SV15
Feed pump MD1
Vacuum pump VP1
OFF
Stop
Upper dead point


ISE Wash Time Chart
Cycle 3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
12-cell rotation
Stop
5-cell rotation
Stop
32-cell rotation
Sampling mechanism wash
*1
↓: PCP check
S syringe (5.1 to 50 µL)
Air discharge
Aspiration
Air aspiration
Air aspiration
S syringe SV2
OFF
S nozzle outside wash SV8
OFF
Reagent dispensing mechanism
Upper dead point
R syringe
R syringe SV3
OFF
R nozzle outside wash SV6
OFF
Stirring mechanism
Upper dead point
Stirring rod rotation
OFF
Stirring rod outside wash SV5
OFF
Reagent disk
Stop
Sample disk
Stop
Rotation
1-pitch feed
ISE sipper mechanism
Upper dead point
ISE syringe
Upper dead point
ISE syringe SV16
OFF
Na/K/Cl SV17
OFF
KCl SV18
OFF
Pinch valve SV19
OFF
Cell rinse mechanism
Stop at upper dead point
Up
Middle
Concentrated/dilute vacuum waste solution SV14
ON
ON
OFF
Concentrated waste solution SV13
OFF
ON
Dilute waste solution SV12
OFF
ON
Cell blank SV10
OFF
Cell rinse SV11
ON
Trough rise SV9
OFF
Incubation bath water supply SV4
OFF
Incubation bath heater
ON
Light source lamp
ON
Incubation bath circulating pump MD2
ON
Incubation bath water drain SV15
OFF
Feed pump MD1
ON
Vacuum pump VP1
ON
*1 Aspiration of rinse solution at W2 position, 24 µL


ISE Wash Time Chart
Cycle 4 to 8
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
12-cell rotation
Stop
5-cell rotation
Stop
32-cell rotation
↓: PCP check
Sampling mechanism wash
S discharge, 10 µL
Wash
Aspiration,
S syringe (5.1 to 50 µL)
S discharge
Remainder discharge
Air discharge
Air aspiration
Air aspiration
Aspiration,
S syringe SV2
ON
OFF
Sample aspiration is not conducted in cycle 8.
S nozzle outside wash SV8
ON
OFF
*1 Aspiration of rinse solution at W2 position
Reagent dispensing mechanism
Upper dead point
Dilution
Wash
R syringe
Water aspiration
Air aspiration
Discharge
Remainder discharge
R syringe SV3
OFF
ON
R nozzle outside wash SV6
OFF
ON
Stirring mechanism
Upper dead point
Wash
Stirring rod rotation
OFF
ON
ON
Stirring rod outside wash SV5
OFF
ON
Reagent disk
Stop
Sample disk
Stop at W2 position
ISE sipper mechanism
Upper dead point
ISE syringe
Upper dead point
ISE syringe SV16
OFF
Na/K/Cl SV17
OFF
KCl SV18
OFF
Pinch valve SV19
OFF
This cycle is repeated 5 times.
Cell rinse mechanism
Stop at upper dead point
Up
Middle
Concentrated/dilute vacuum waste solution SV14
ON
ON
OFF
Concentrated waste solution SV13
OFF
ON
Dilute waste solution SV12
OFF
ON
Cell blank SV10
OFF
Cell rinse SV11
ON
Trough rise SV9
OFF
Incubation bath water supply SV4
OFF
Incubation bath heater
ON
Light source lamp
ON
Incubation bath circulating pump MD2
ON
Incubation bath water drain SV15
OFF
Feed pump MD1
ON
Vacuum pump VP1
ON


ISE Wash Time Chart
Cycle 9 to 17
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
12-cell rotation
Stop
5-cell rotation
12-cell rotation
Stop
32-cell rotation
↓: PCP check
Sampling mechanism wash
Conducted only in cycle 17
S syringe (5.1 to 50 µL)
S syringe SV2
OFF
Not conducted in cycle 17
S nozzle outside wash SV8
OFF
Reagent dispensing mechanism
Upper dead point
Internal standard
Aspiration, 356 µL
Wash
Repeated 3 times
R syringe
Air aspiration
Discharge
Remainder discharge
R syringe SV3
OFF
ON
R nozzle outside wash SV6
OFF
ON
Stirring mechanism
Upper dead point
Stirring rod rotation
OFF
Stirring rod outside wash SV5
OFF
Reagent disk
Stop
Rotation
Stop at internal standard position no. 37
Sample disk
Stop
ISE sipper mechanism
Upper dead point
ISE syringe
Upper dead point
Aspiration, 310 µL
Discharge (rinse solution + internal standard)
ISE syringe SV16
OFF
Repeated 5 times from cycle 10 and then internal standard aspiration repeated 3 times
Na/K/Cl SV17
ON
OFF
KCl SV18
OFF
Pinch valve SV19
ON
OFF
Cell rinse mechanism
Stop at upper dead point
Up
Middle
Concentrated/dilute vacuum waste solution SV14
ON
ON
OFF
Concentrated waste solution SV13
OFF
ON
Dilute waste solution SV12
OFF
ON
Cell blank SV10
OFF
Cell rinse SV11
ON
Trough rise SV9
OFF
Incubation bath water supply SV4
OFF
Incubation bath heater
ON
Light source lamp
ON
Incubation bath circulating pump MD2
ON
Incubation bath water drain SV15
OFF
Feed pump MD1
ON
Vacuum pump VP1
ON

6. SWITCH SETTING

6.1 Short Pins on Mother Board 6-1

6.2 Setting of DIP Switch on ECPU237 Board 6-1

6.3 Setting on DIP Switches on EMOT200 Board 6-1

6.4 LOG AMP (P/N 707-5009 6-2

6.5 ISE AMP (P/N 707-5023) 6-2

6.6 Setting and Function of YD-702D-6539 Short Plugs 6-3

6. SWITCH SETTING

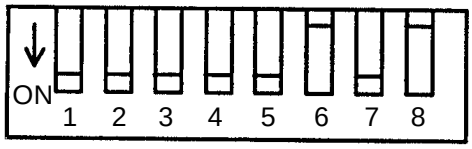
6.1 Short Pins on Mother Board

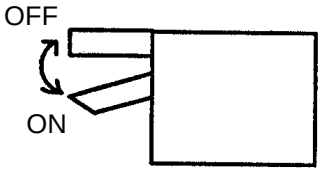
Make sure that the mother board (MVSB100) is provided with short pins.
JP5 and JP10 in the unoccupied slots (2nd and 3rd slots) should be shorted.

6.2 Setting of DIP Switch on ECPU237 Board

Set the DIP switch (8 pins) on the ECPU237 board as follows.

SW 1	2	3	4	5	6	7	8
ON	ON	ON	ON	ON	OFF	ON	OFF





6.3 Setting of DIP Switches on EMOT200 Board

The following table shows DIP switch settings on the EMOT200 board.

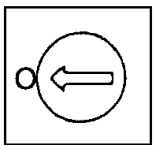
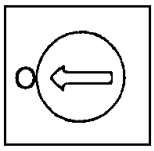
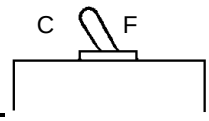
(1) SW1

SW No.	Function	Description
1	Photometer wavelength	OFF: For domestic use and Asia ON : For Europe and USA
2	Unused	
3	Unused	
4	Unused	
5	Unused	
6	For serviceman	ON : Test count clear, probe adjust pulse input enabled
7	Alarm release	ON : Alarm release
8	For debugging	ON : Watchdog release

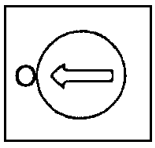
(2) SW2

SW No.	Function	Description
1	Sample transfer	ON : With sample transfer
2	External personal computer	ON : With external personal computer
3	Unused	
4	Sample ID	ON : With sample ID
5	ISE	ON : With ISE
6	Unused	
7	Unused	
8	Unused	

6.4 LOG AMP (P/N 707-5009)

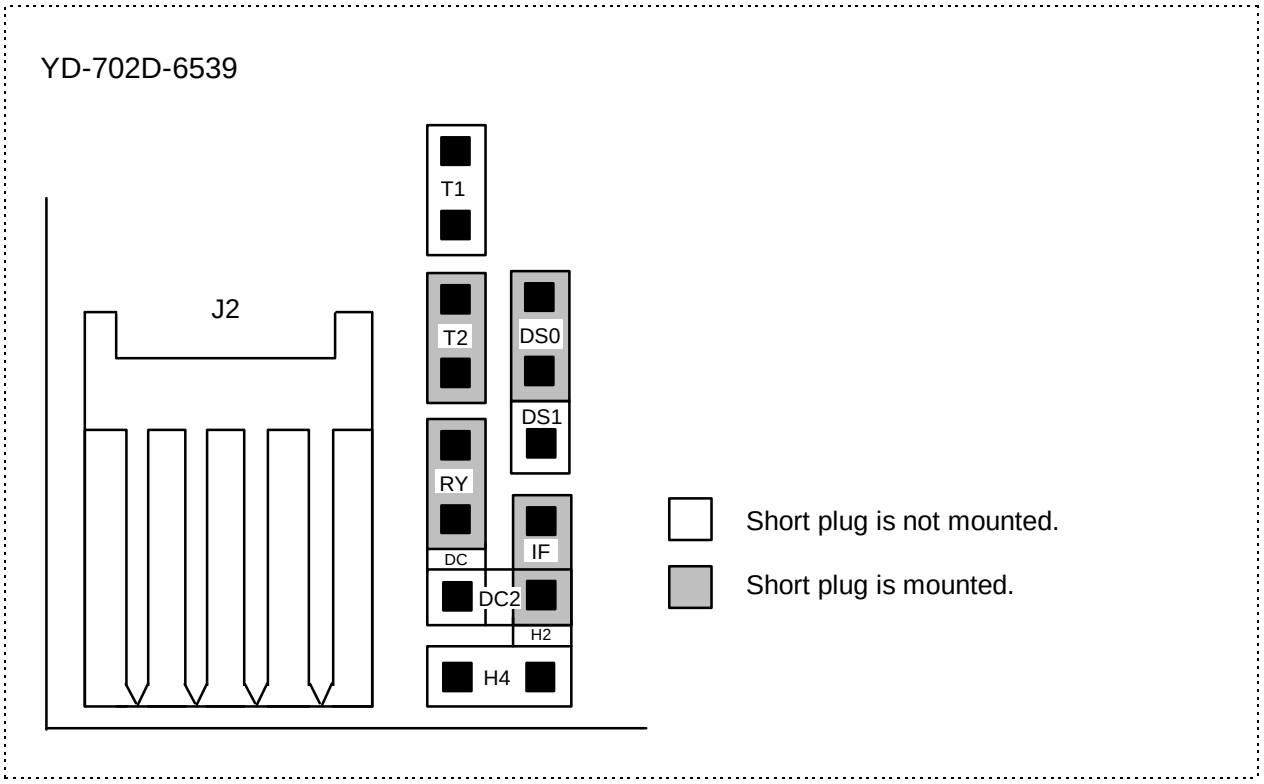
SW No.	Type	Setting	Remarks
SW1	Rotary	O 	Selection of main wavelength
SW2	Rotary	O 	Selection of sub wavelength
SW3	Toggle	C 	Multiplexer (F: manual setting)

6.5 ISE AMP (P/N 707-5023)

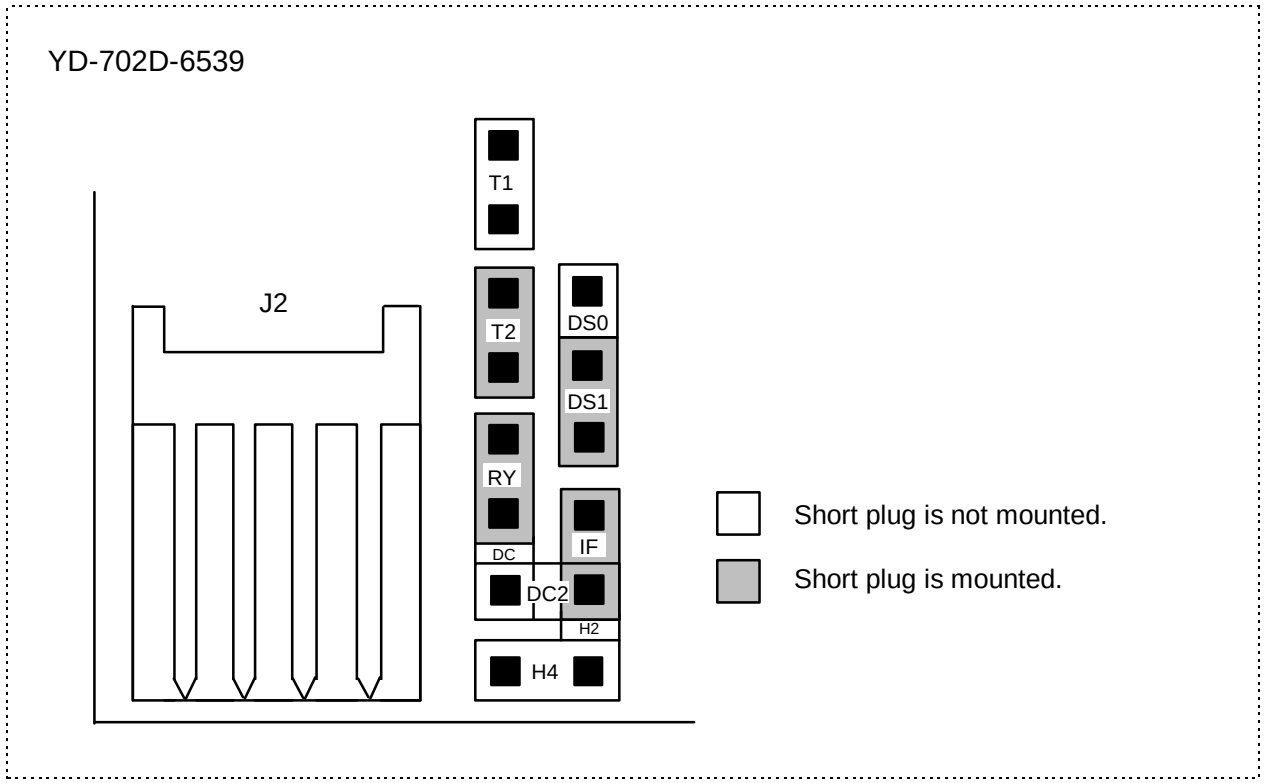
SW No.	Type	Setting	Remarks
SW1	Rotary	O 	Address setting

6.6 Setting of YD-702D-6539 Short Plugs

Setting of Drive 1

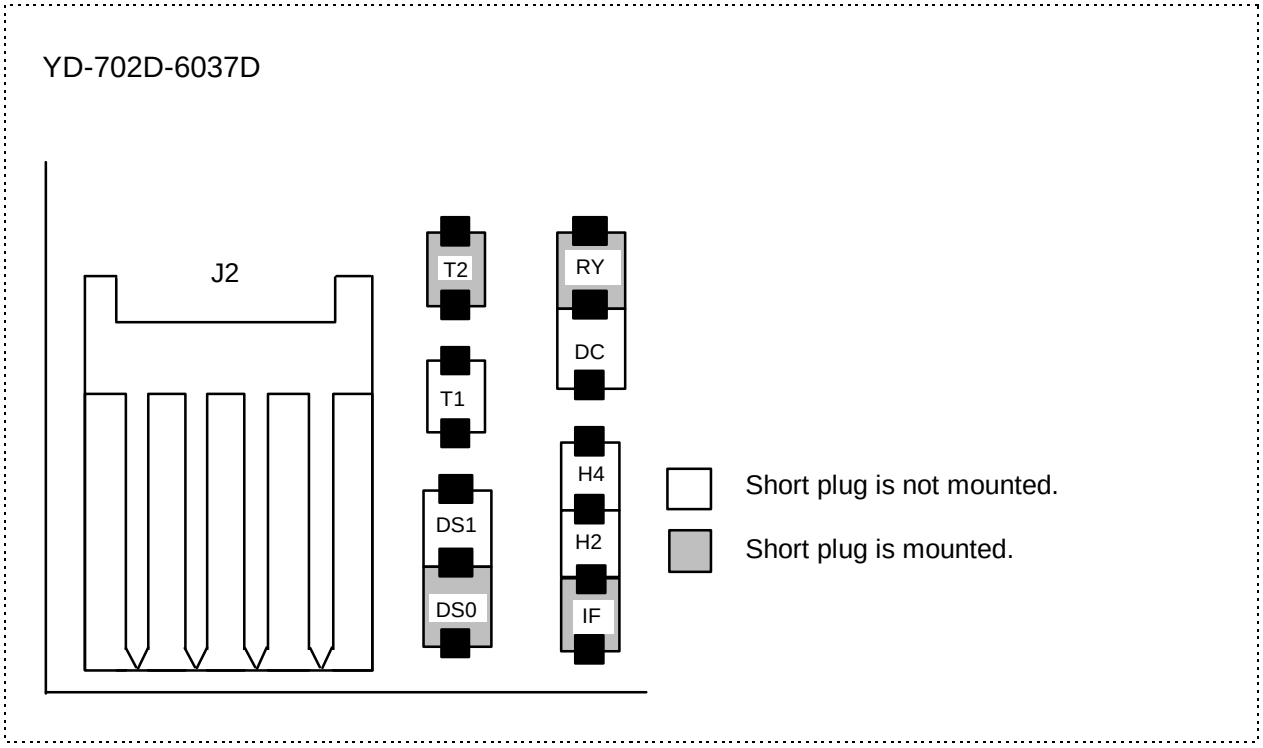


Setting of Drive 2

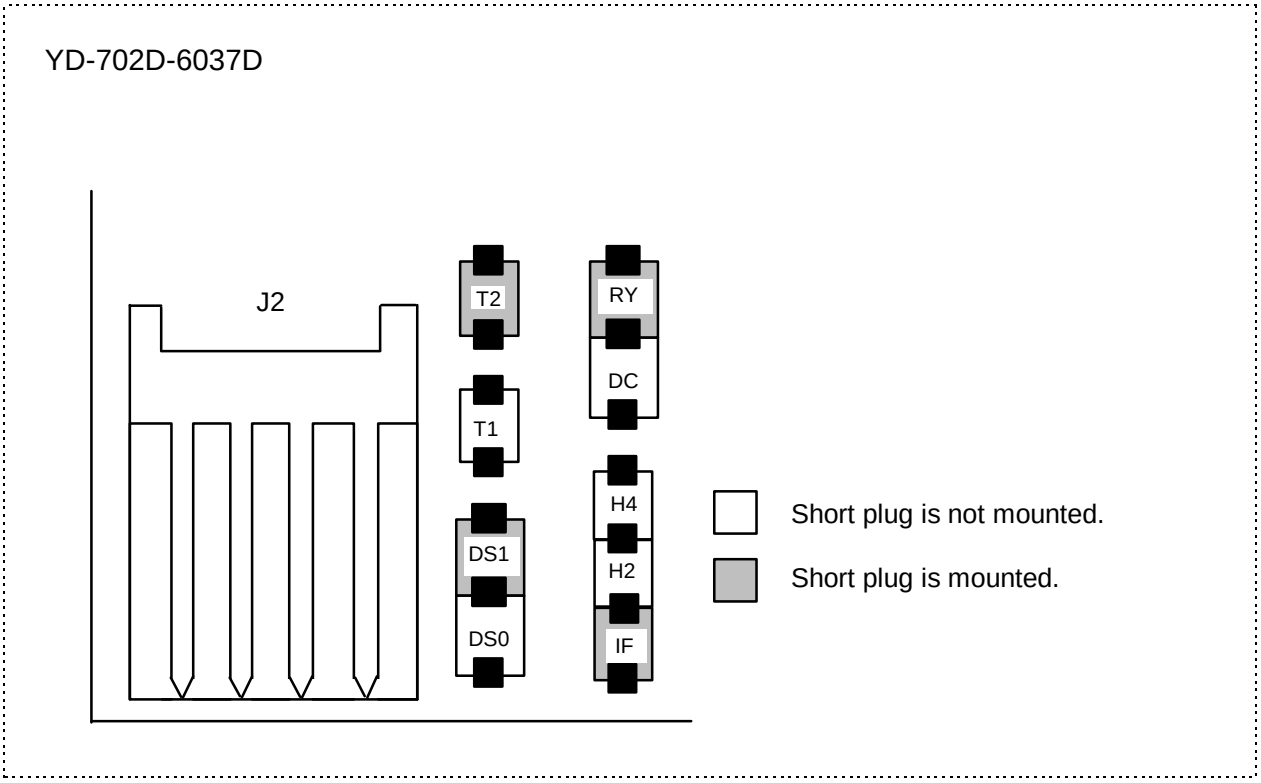


6.6 Setting of YD-702D-6037D Short Plugs

Setting of Drive 1



Setting of Drive 2



Function of Each Short Plug

<table>
<tr><th>Designation of Short Pin</th><th>Function</th></tr>
<tr><td>IF
T1
T2</td><td>
Selection of how to change recording capacity mode
<table>
<tr><th>IF</th><th>T1</th><th>T2</th><th>Function</th></tr>
<tr><td>O</td><td>O</td><td>O</td><td>2 modes (2.0/1.0 MB)
Automatic changeover with inserted disk
2.0 MB : When HD disk is used
1.0 MB : When DD disk is used</td></tr>
<tr><td>S</td><td>S</td><td>O</td><td>2 modes (2.0/1.0 MB)
Changeover with MODE SELECT signal
2.0 MB : When MODE SELECT signal is "HIGH"
1.0 MB : When MODE SELECT signal is "LOW"</td></tr>
<tr><td>S</td><td>S</td><td>S</td><td>2 modes (2.0/1.0 MB)
Changeover with MODE SELECT signal
2.0 MB : When MODE SELECT signal is "LOW"
1.0 MB : When MODE SELECT signal is "HIGH"</td></tr>
<tr><td>S</td><td>O</td><td>O</td><td>3 modes (2.0/1.6/1.0 MB)
Changeover with inserted disk plus MODE SELECT signal
2.0 MB : When HD disk is used and MODE SELECT signal is "HIGH"
1.6 MB : When HD disk is used and MODE SELECT signal is "LOW"
1.0 MB : When DD disk is used regardless of MODE SELECT signal</td></tr>
<tr><td>S</td><td>O</td><td>S</td><td>3 modes (2.0/1.6/1.0 MB)
Changeover with inserted disk plus MODE SELECT signal
2.0 MB : When HD disk is used and MODE SELECT signal is "LOW"
1.6 MB : When HD disk is used and MODE SELECT signal is "HIGH"
1.0 MB : When DD disk is used regardless of MODE SELECT signal</td></tr>
<tr><td>O</td><td>O</td><td>S</td><td>2 modes (1.6/1.0 MB)
Automatic changeover with inserted disk
1.6 MB : When HD disk is used
1.0 MB : When DD disk is used</td></tr>
</table>
Note: The recording capacity mode is changed over with the logic level ("H"/"L") of MODE SELECT signal.
</td></tr>
<tr><td>H2
H4</td><td>
Selection of HIGH DENSITY signal output pin
<table>
<tr><th>H2</th><th>H4</th><th>Function</th></tr>
<tr><td>S</td><td>O</td><td>Output to J1-2 pin</td></tr>
<tr><td>O</td><td>S</td><td>Output to J1-4 pin</td></tr>
<tr><td>O</td><td>O</td><td>Not output (open)</td></tr>
</table>
</td></tr>
</table>

(cont'd)

<table>
<tr><th>Designation of Short Pin</th><th>Function</th></tr>
<tr><td>DC
RY</td><td>Selection of J1-3, 4 pin output signal function
<table>
<tr><th>DC</th><th>RY</th><th>Function</th></tr>
<tr><td>O</td><td>S</td><td>Output of READY signal</td></tr>
<tr><td>S</td><td>O</td><td>Output of DISK CHANGE signal</td></tr>
<tr><td>O</td><td>O</td><td>Open</td></tr>
</table></td></tr>
<tr><td>DS0, 1</td><td>Drive selection</td></tr>
</table>

Function of short plug S: Shorted, O: Opened

7. EXPLANATION OF FUNCTIONS

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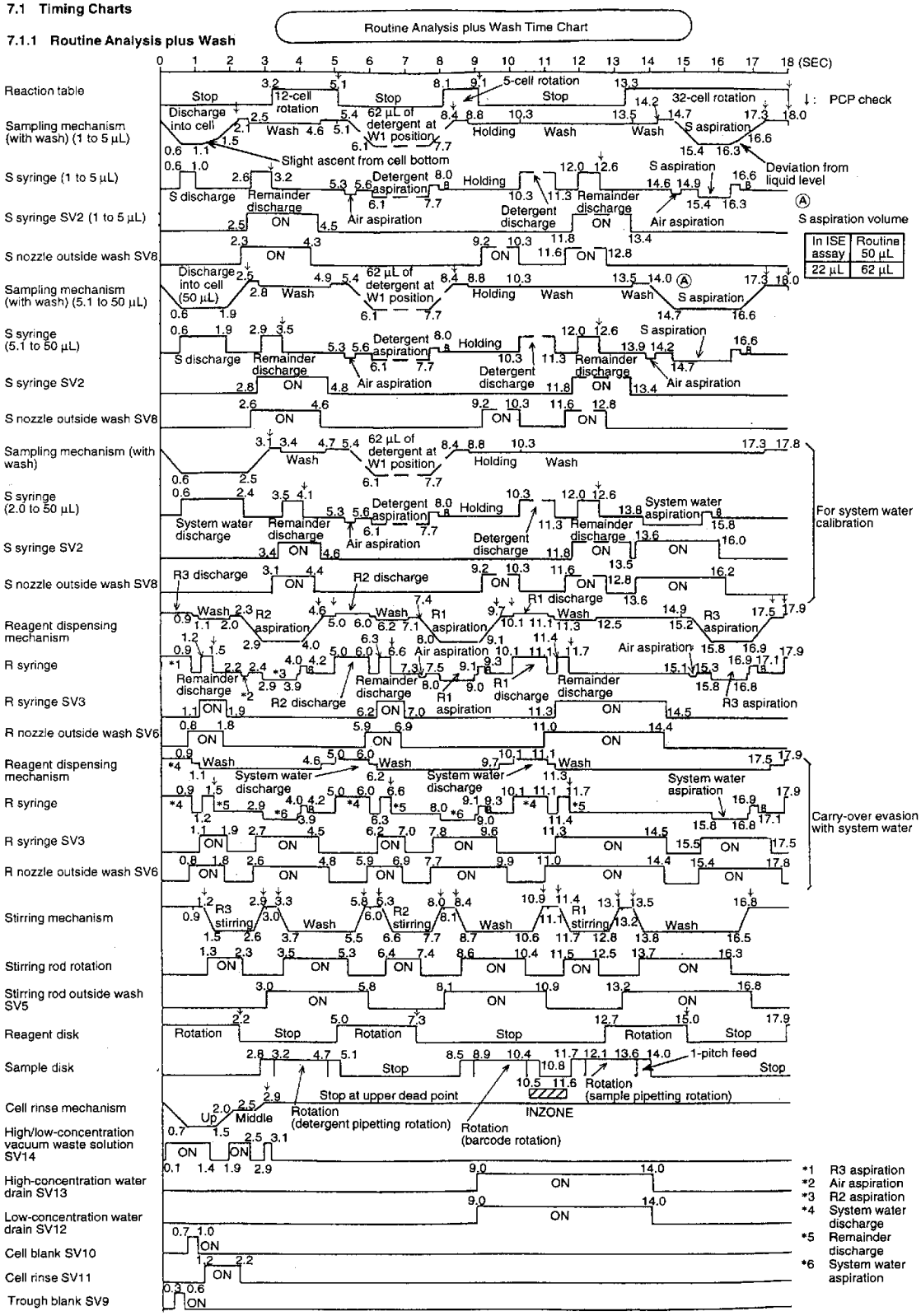
7. EXPLANATION OF FUNCTION

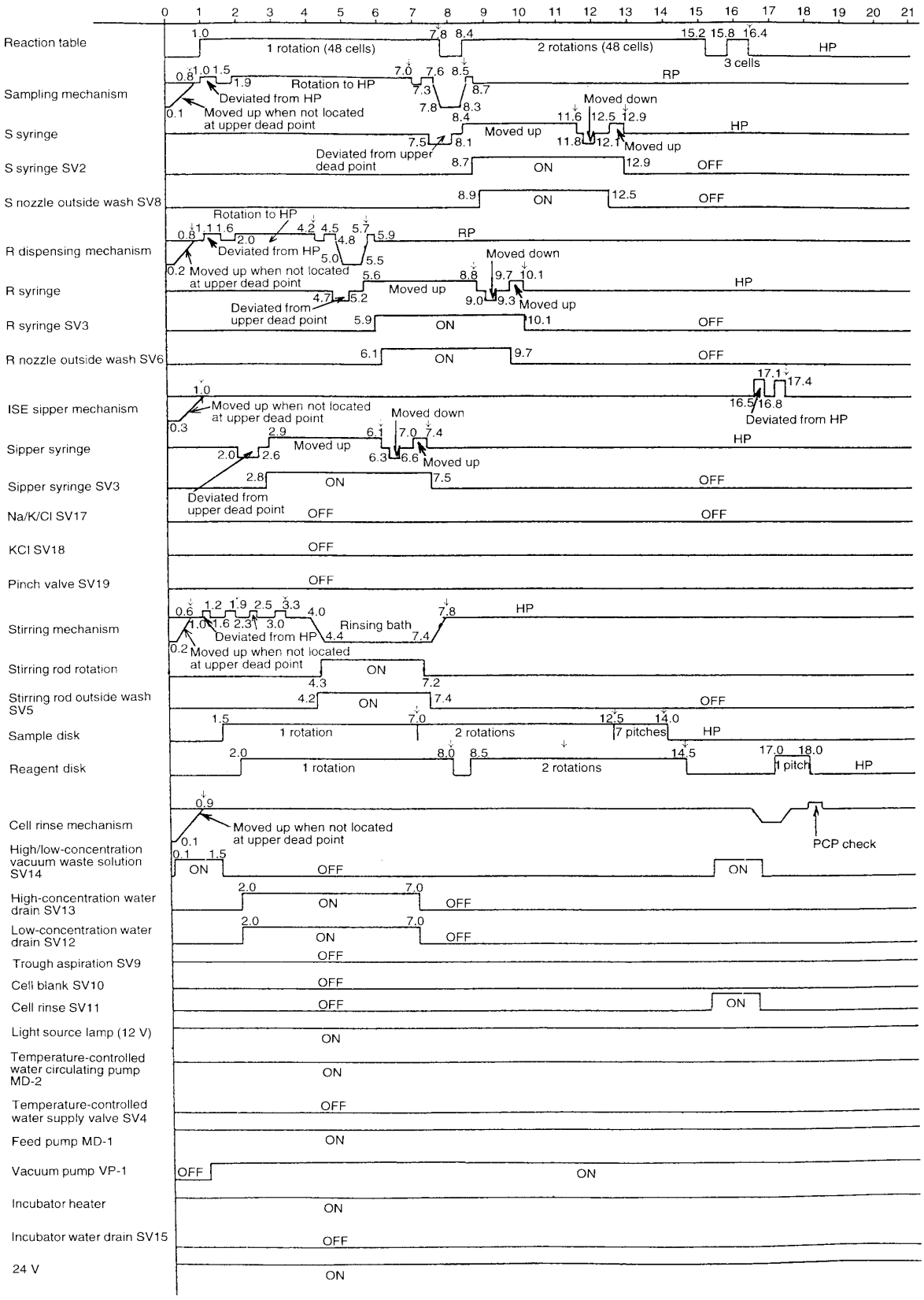
7.1 Timing Charts

7.1.1 Routine Analysis plus Wash

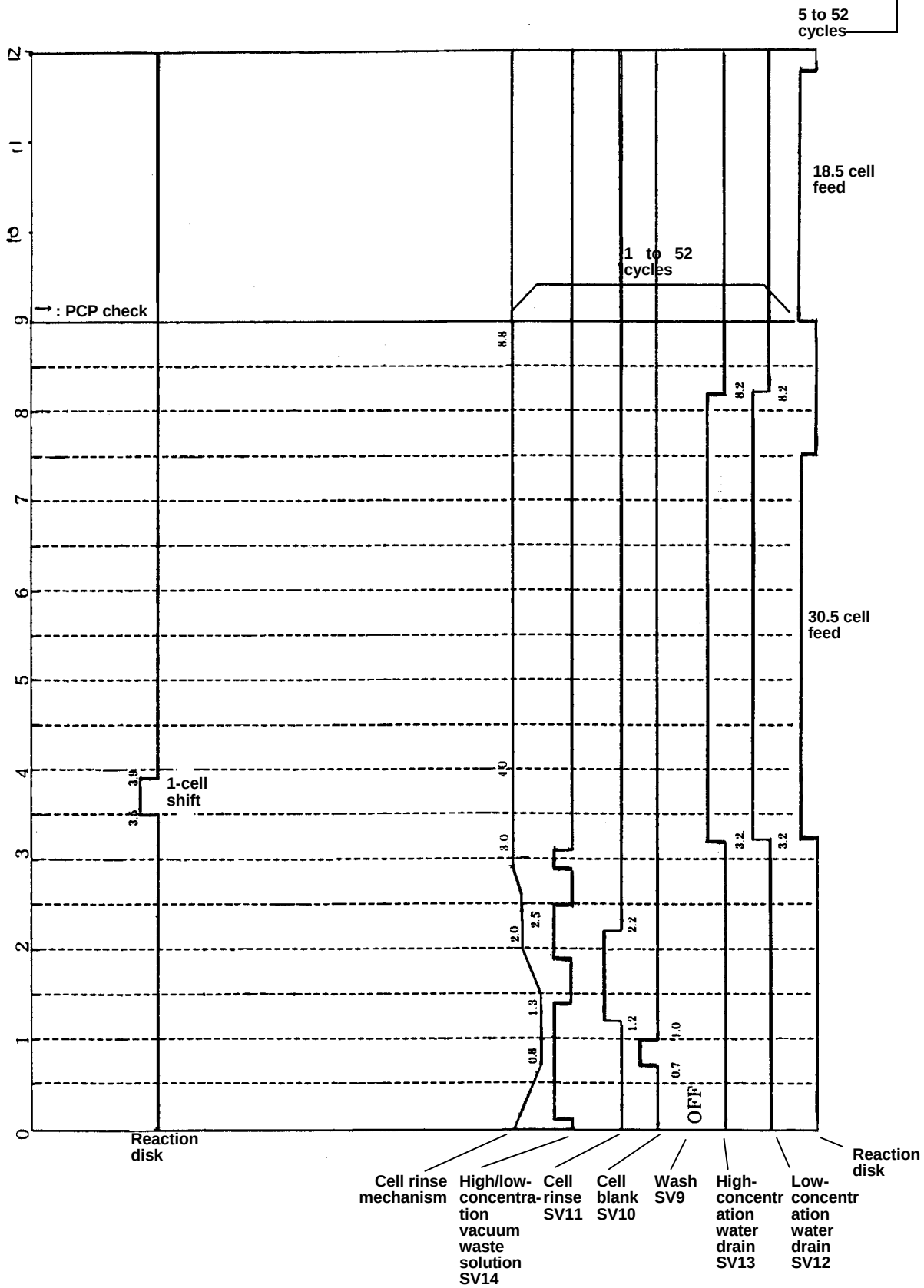


7.1.2 Reset

Reset Time Chart

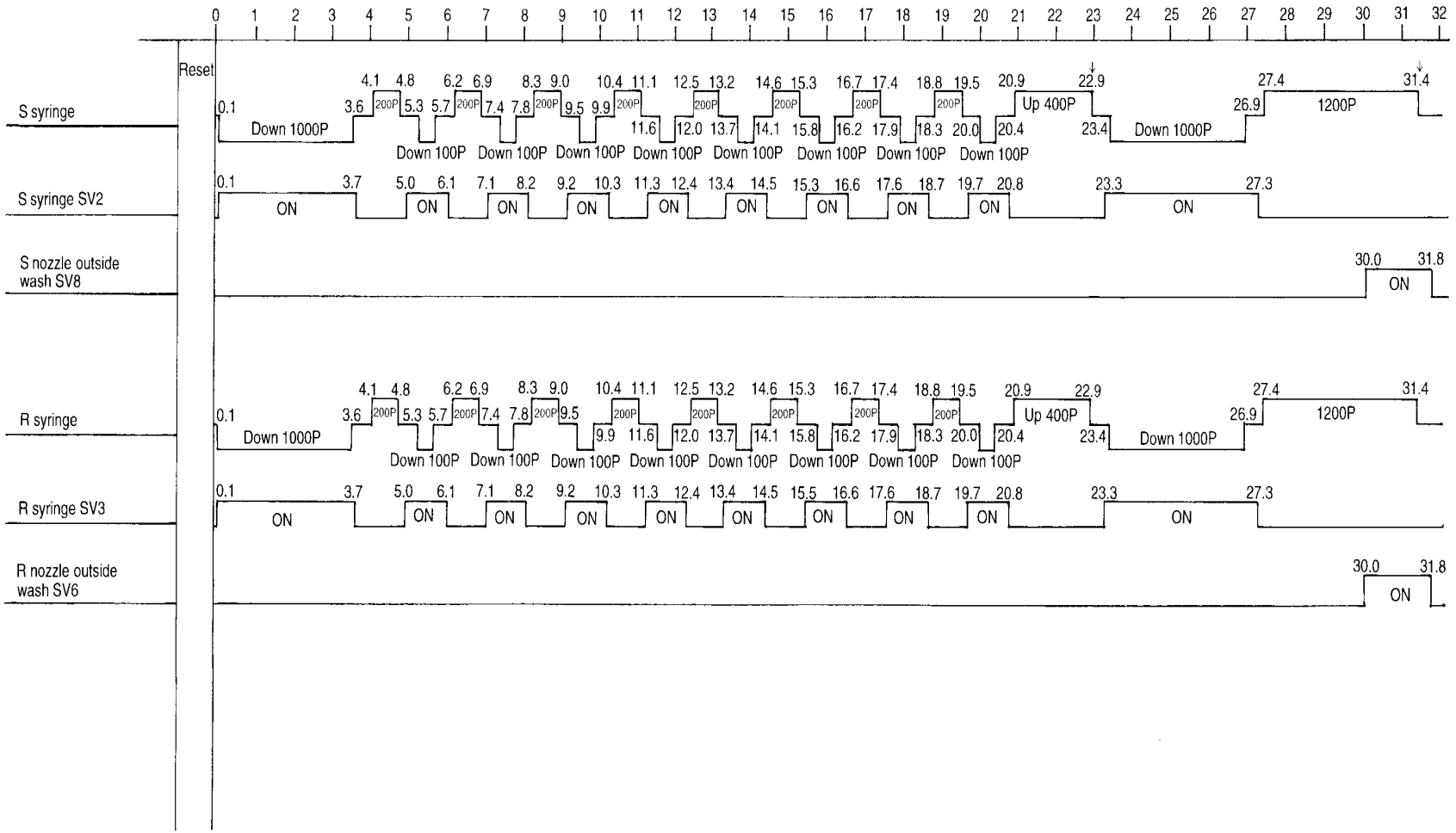


7.1.3 T/M Cell Blank Measurement Time Chart

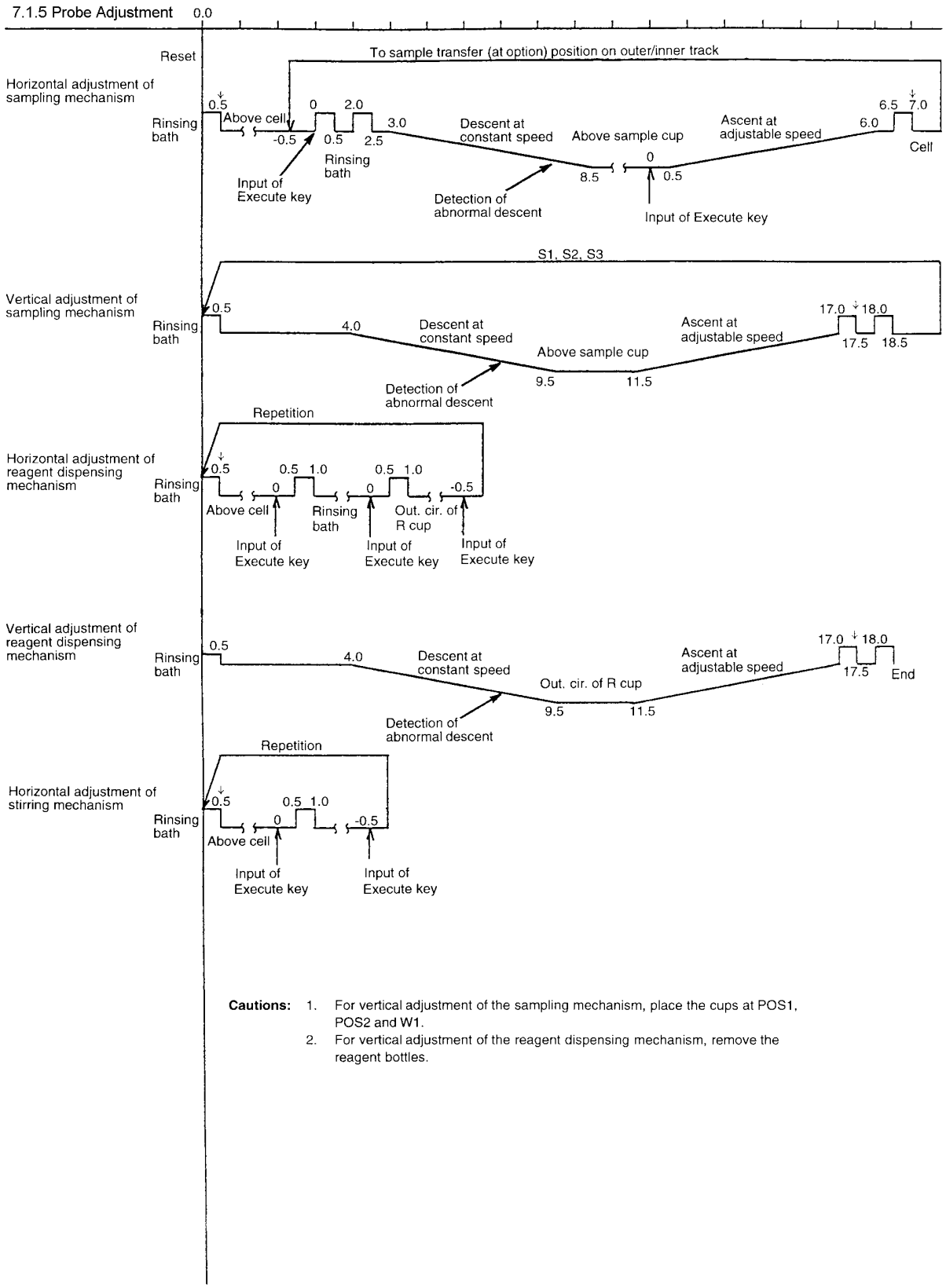


Air Purge (only in photometry assay)

7.1.4 Air Purge



7.1.5 Probe Adjustment

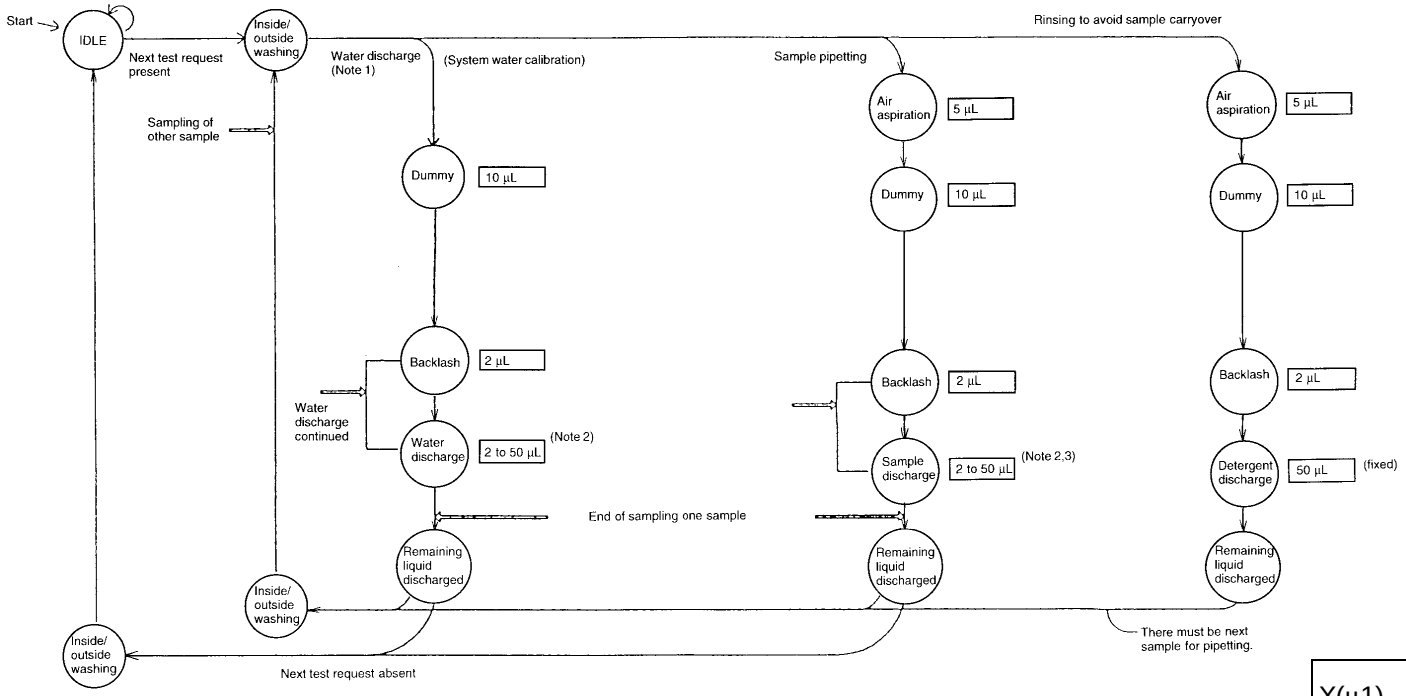


Cautions: 1. For vertical adjustment of the sampling mechanism, place the cups at POS1, POS2 and W1.
2. For vertical adjustment of the reagent dispensing mechanism, remove the reagent bottles.

7.1.6 Operation

(1) Operation (sample probe)

1. Function
   - To discharge sample into reaction cell (photometry and ISE assays)
   - To discharge rinse water into reaction cell
2. Sample probe status transition



NOTES:

1. When STD (1) POS#99 is specified in analytical parameters .
2. Sample pipettiing volume conpensation :

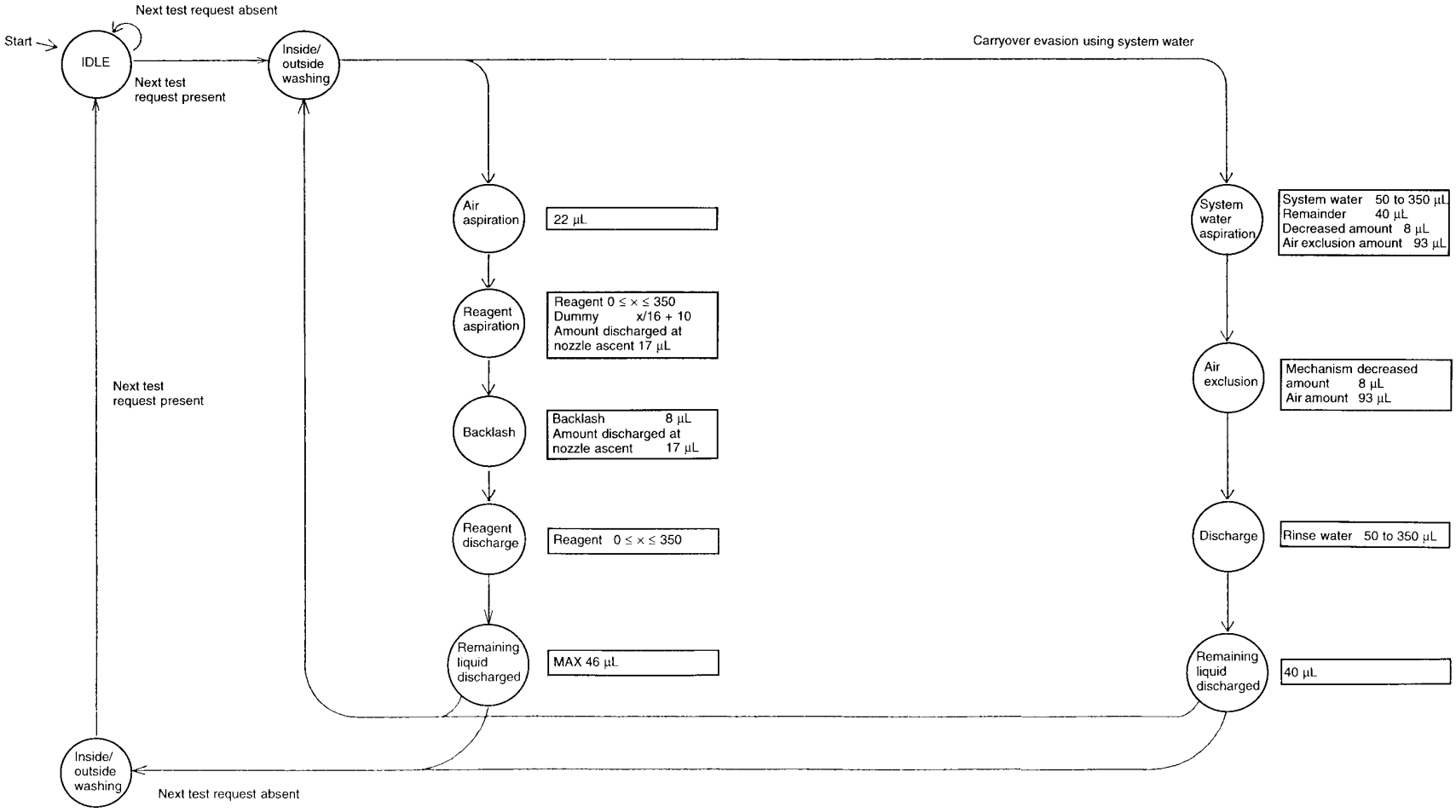
Actual pipetting volume "yµL" versus value input from screen "xµL" is calculated via following formula.

X(µ1)	y(µ1)
20.0 to 15.5	x
15.6 to 25.5	1.04788 × -0.7109
25.6 to 50.0	1.03160 × -0.2479

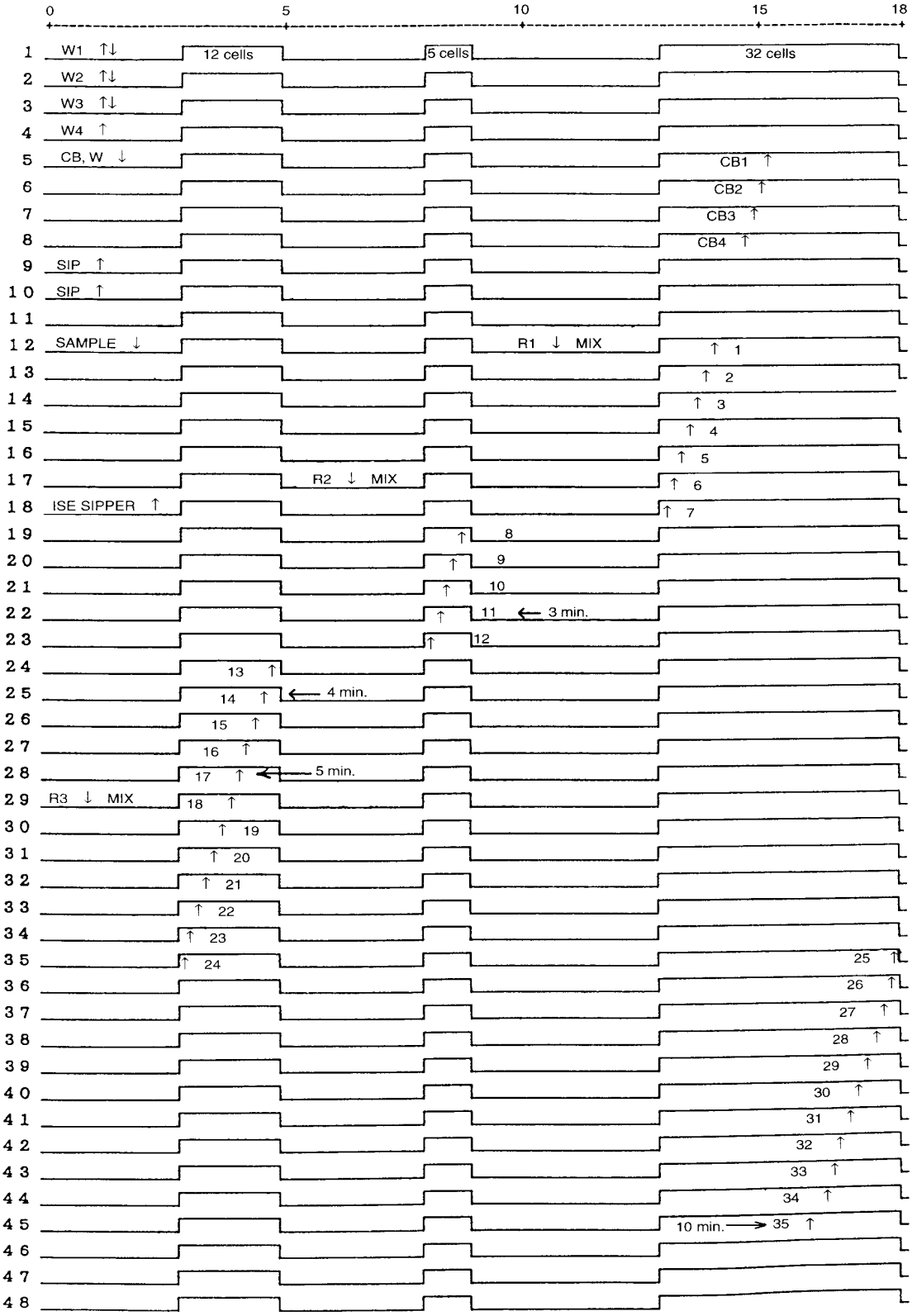
3. One addional pulse is applied for sample aspiration and discharge .

(2) Operation (reagent probe)

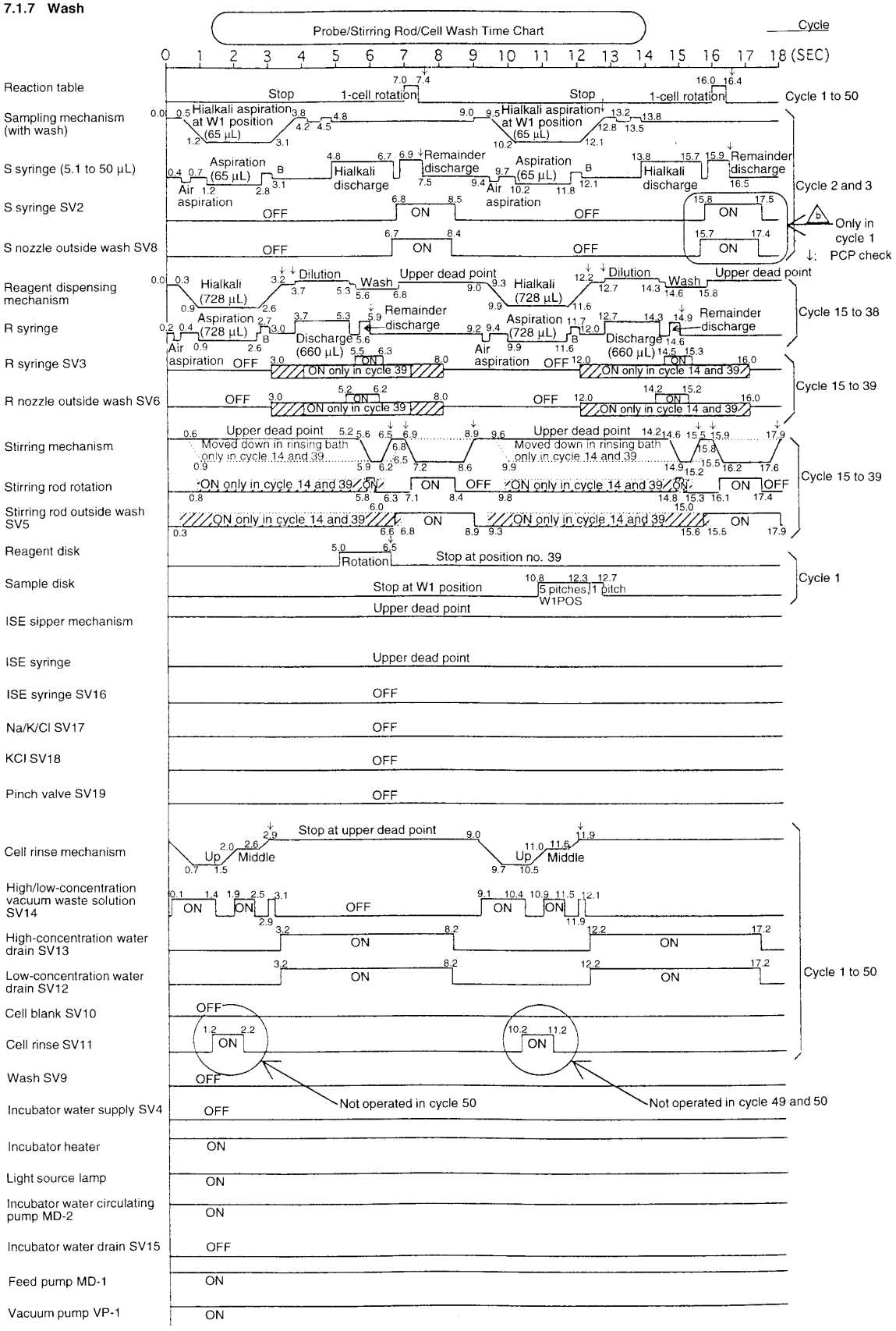
1. Reagent probe status transition



(3) Operation (photometry/ISE measuremment sequence)

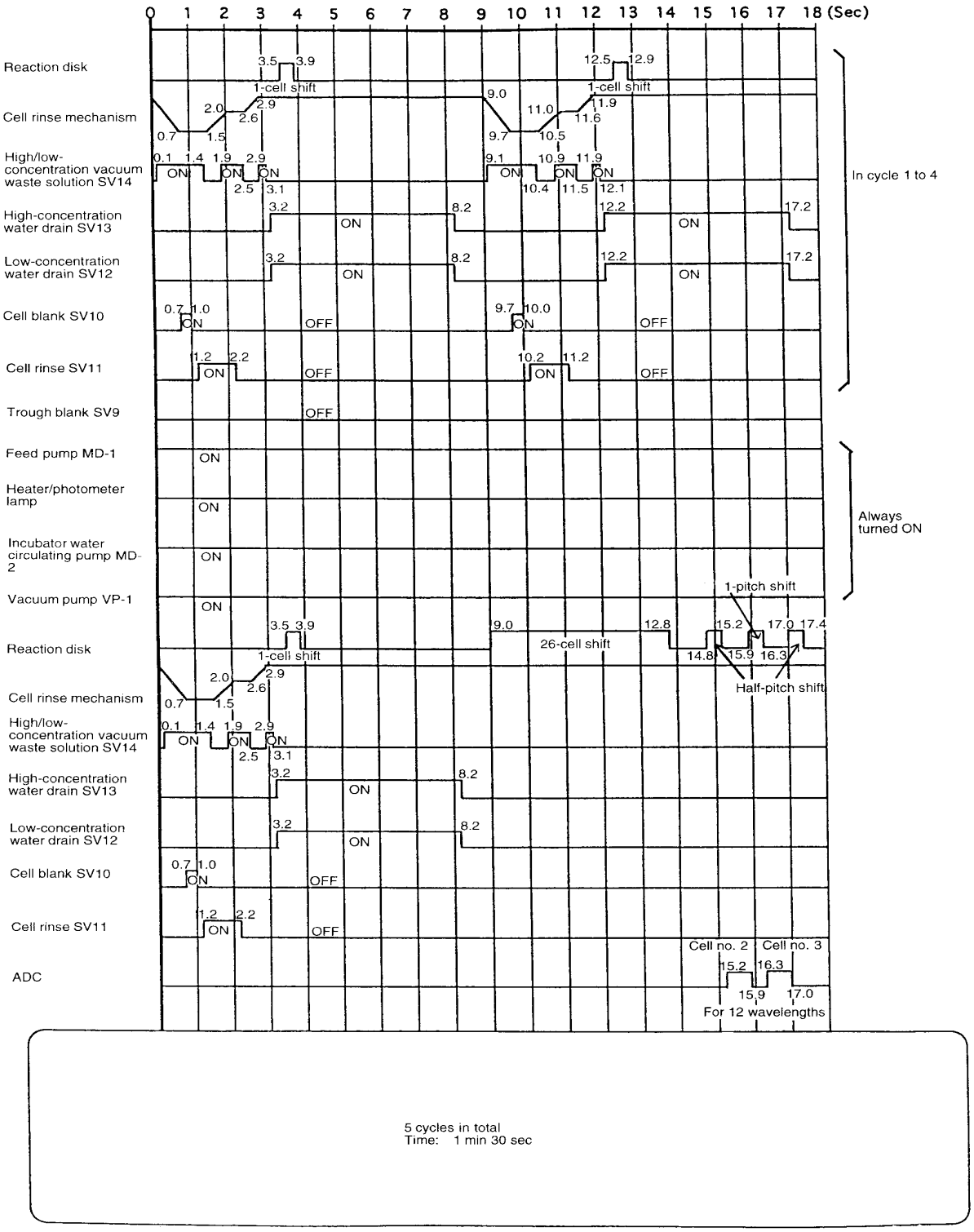


7.1.7 Wash


Probe/Stirring Rod/Cell Wash Time Chart
Cycle
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 (SEC)
Reaction table
Stop
1-cell rotation
Cycle 1 to 50
Sampling mechanism (with wash)
Hialkali aspiration at W1 position (65 µL)
S syringe (5.1 to 50 µL)
Aspiration (65 µL)
Air aspiration
Hialkali discharge
Remainder discharge
Cycle 2 and 3
S syringe SV2
OFF
ON
S nozzle outside wash SV8
Only in cycle 1
↓: PCP check
Reagent dispensing mechanism
Hialkali (728 µL)
Dilution
Wash
Upper dead point
Cycle 15 to 38
R syringe
Aspiration (728 µL)
Discharge (660 µL)
R syringe SV3
ON only in cycle 39
Cycle 15 to 39
R nozzle outside wash SV6
ON only in cycle 14 and 39
Stirring mechanism
Moved down in rinsing bath only in cycle 14 and 39
Stirring rod rotation
Stirring rod outside wash SV5
Reagent disk
Rotation
Stop at position no. 39
Cycle 1
Sample disk
Stop at W1 position
5 pitches/1 pitch
W1POS
ISE sipper mechanism
ISE syringe
ISE syringe SV16
Na/K/Cl SV17
KCl SV18
Pinch valve SV19
Cell rinse mechanism
Stop at upper dead point
Up
Middle
High/low-concentration vacuum waste solution SV14
High-concentration water drain SV13
Low-concentration water drain SV12
Cycle 1 to 50
Cell blank SV10
Cell rinse SV11
Wash SV9
Not operated in cycle 50
Not operated in cycle 49 and 50
Incubator water supply SV4
Incubator heater
Light source lamp
Incubator water circulating pump MD-2
Incubator water drain SV15
Feed pump MD-1
Vacuum pump VP-1

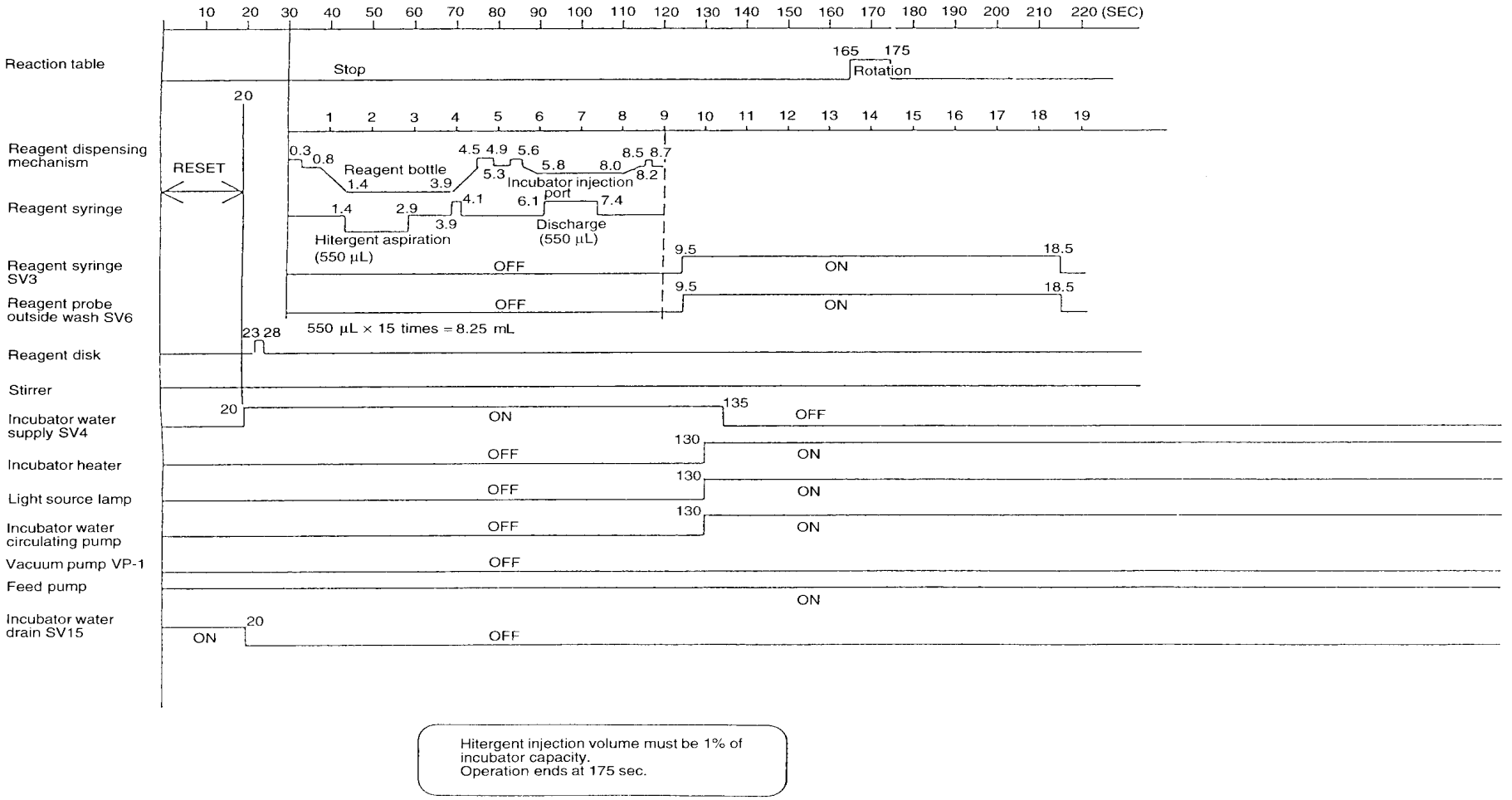
7.1.8 Photometer Check

T/M Photometer Check Time Chart



7.1.9 Water Exchange

Incubator Water Exchange



Hitergent injection volume must be 1% of incubator capacity.
Operation ends at 175 sec.

7.2 Measurement

(1) Forty-nine cells are measured in each cycle.

(2) Thirty-nine measurements (4 cell blank measurements, 35 sample absorbance measurements) are made in each cycle.

(3) In case of at least one ADC failure in thirty-nine measurements, data is 0 and ADC alarm is added.

(4) ADC

(a) Time: Refer to the description of ADC parameters.

(b) Calibration equation $\times 100{,}000 = \frac{16667}{B - A} X \frac{63338B - 25000A}{B - A}$

ABS in terms of 10 mm cell
(measured with 6 mm cell)

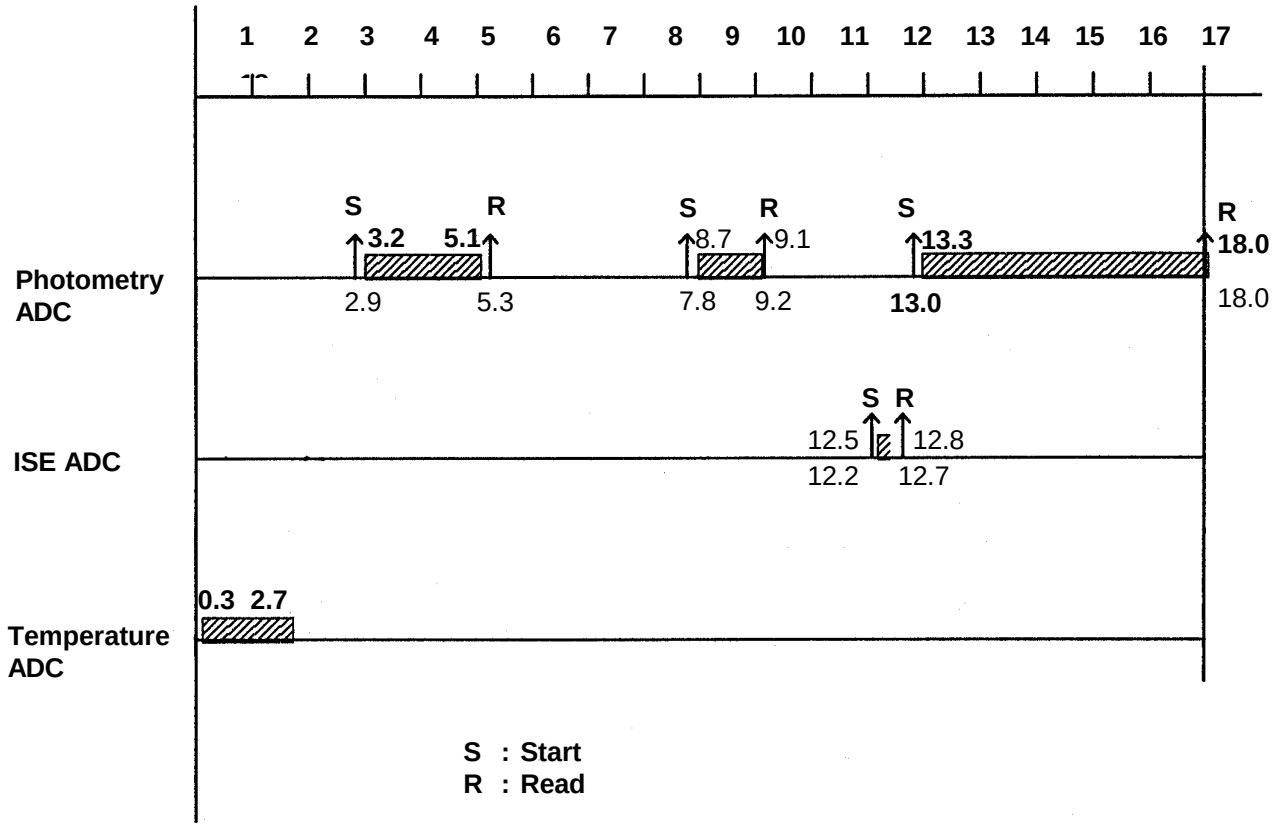
A = Calibrated ADC count for 2 V voltage
B = Calibrated ADC count for 6 V voltage
C = Measured ADC count

(c) Immediately after calibration, subtraction is made atB initialization, resetting upon operation start and T/M resetting. Note, however, that data at initialization is discarded.
At this time, ADC CALIB alarm is issued if A or B is out of the range given below.
$7546 \leq A \leq 8341$
$22640 \geq B \geq 25023$

(d) Number of conversion bits: 16 bits

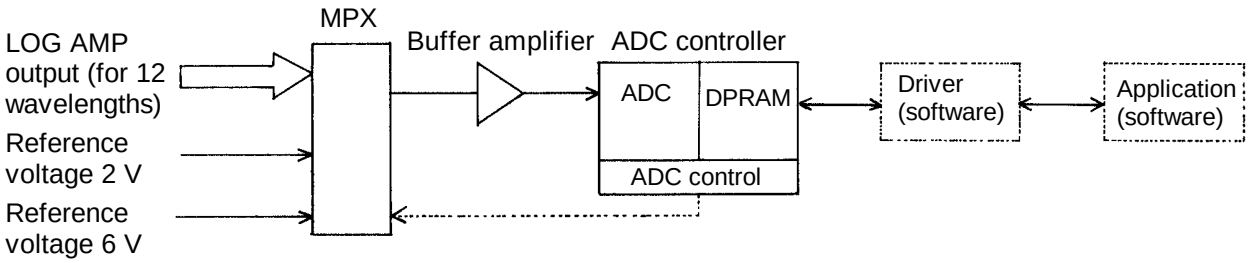
(e) The RESET command is issued to the ADC controller at initialization and T/M resetting.

7.2.1 ADC Timing



7.2.2 Configuration of Photometry ADC Hardware

Configuration of Photometry ADC Hardware



(1) The ADC controller converts the analog values of the LOG AMP output voltage, reference voltage 2 V and reference voltage 6 V to the digital ones upon receiving the instruction from the application via the driver and stores the digital values into the DPRAM.
The values are taken in the application via the driver.

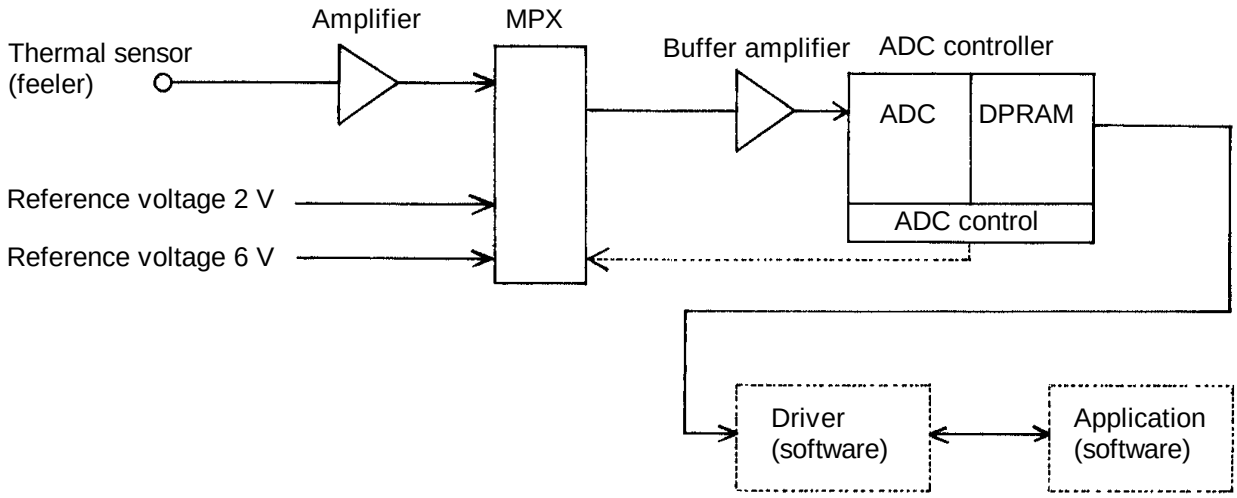
(2) The application accesses to the driver, but does not control the ADC directly.

ADC Setting Parameters

- Integration = 32 times
- Hardware trigger time-out = 150 msec
- Software trigger interval = 30 msec

7.2.3 Configuration of Temperature ADC Hardware

Configuration of Temperature ADC Hardware



(1) The ADC controller converts the analog values of the temperature sensor, reference voltage 2 V and reference voltage 6 V to the digital ones upon receiving the instruction from the application via the driver and stores the digital values into the DPRAM. The values are taken in the application via the driver.

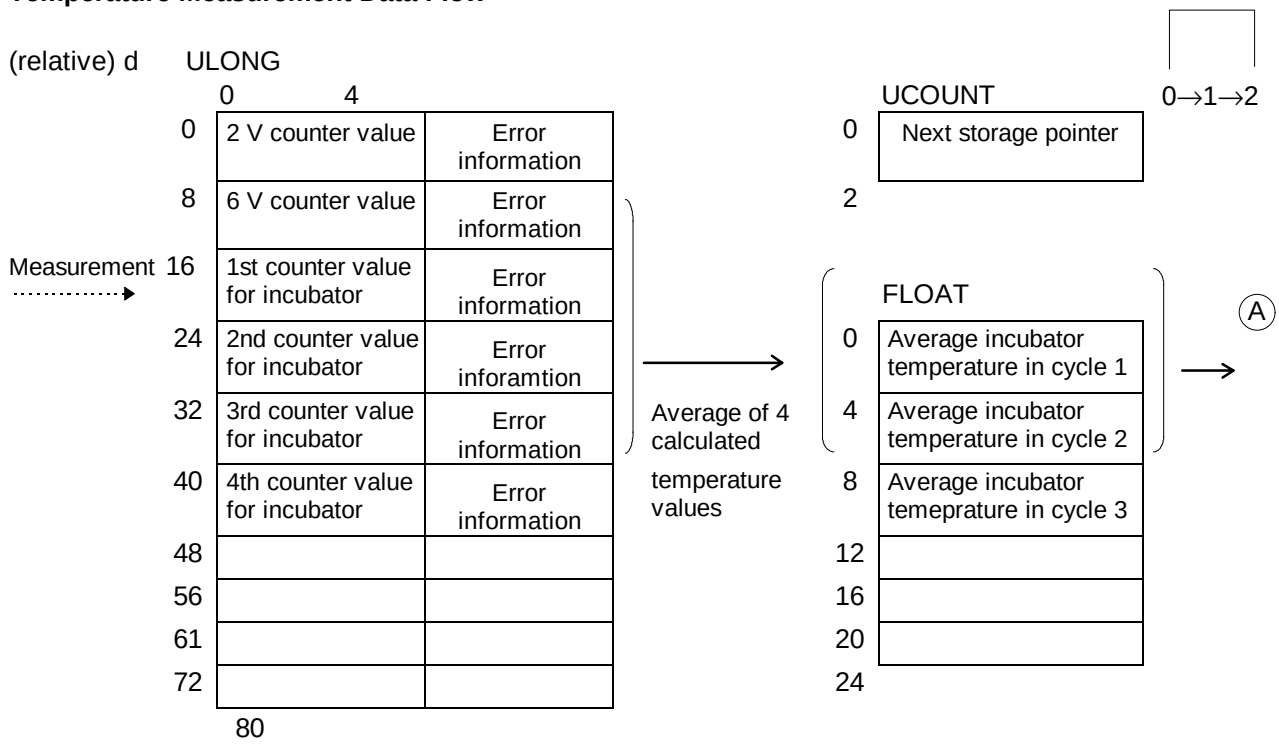
(2) The application accesses to the driver, but does not control the ADC directly.

ADC Setting Parameters

- Integration = 32 times
- Software trigger interval = 30 msec

7.2.4 Temperature Measurement Data Flow

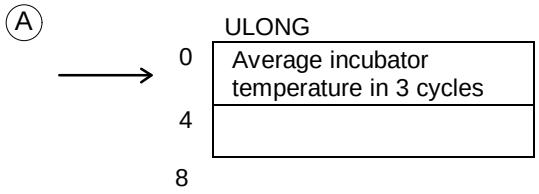
Temperature Measurement Data Flow



Information at acquisition of each counter value is set for error information.
(ADC return information)

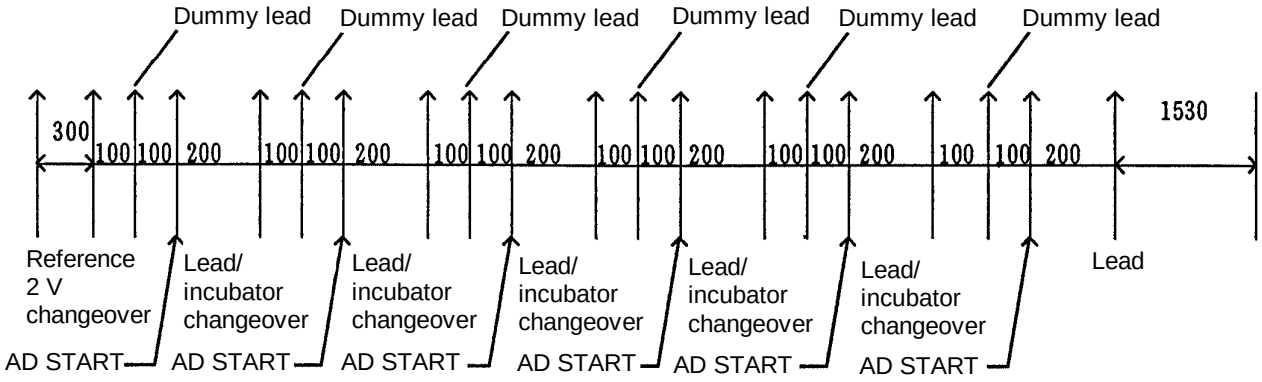
0: Normal
1: Reference 2 V counter value abnormal
2: Reference 6 V counter value abnormal
3: Time-out (200 msec)
4: I/O error

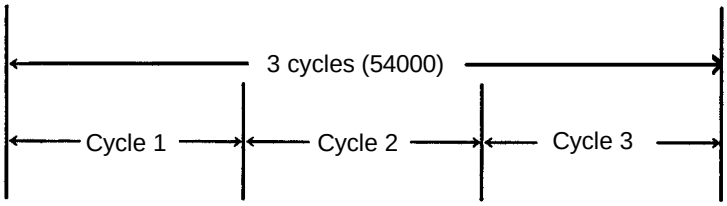
(1) The average of 4 calculated temperature values is set to the relevant temperature storage area indicated by the pointer.
(2) Error InformationData
  1) In the event of error in reference 2 V/6 V measurement, "0" is set for both temperatures indicated by the pointer.
  2) In the event of error in incubator temperature measurement, "0" is set for the temperature.
(3) The temperature is "0" unless 3 cycles pass after initial startup, because all temperatures are not set.
(unmeasured area)



(1) Set the average value in 3 cycles. (value rounded to 1st decimal point and multiplied by 10)
(2) If "0" (error)is acquired at least once for the temperature in cycle 1 to 3, "0" is set for the relevant temperature. In addition, alarm judgement at occurrence of error is not made.
In the event of error, 0°C is output to the external object.
(3) If Temperature acquisition is made before the lapse of 3 cycles after intial startup, 0°C is output.

Temperature Measurement Sequence





Temperature ADC : Required time
400 msec × 6 cycles : 2.4 sec

- Calculation/alarm judgement are made in the past three cycles.

  The temperature is judged according to the status and an alarm is output.
  The temperature used for judgement is calculated in the following manner.
  1. Average of 4 temperature values measured in a single cycle
  2. Average temperature in 3 cycles
  3. Alarm judgement by value rounded to 1st decimal point and multiplied by 10

(1) MPX Data

No.	Item	MPX Data
1	Reference voltage (2 V)	6
2	Incubator temeprature	5
3	Reference voltage (6 V)	7

(2) Temperature Calculation Formula

1) Incubator Temperature (Pt feeler)

$$T = 29.0 \times (Y - A)/(B - A) + 7.96$$

T: Incubator temperature (°C)
Y: ADC count value at measurement
A: Count value for reference voltage (2 V)
B: Count value for reference voltage (6 V)

NOTE: The interrupt register is 100 msec before A/D start.

(3) Alarm Specifications

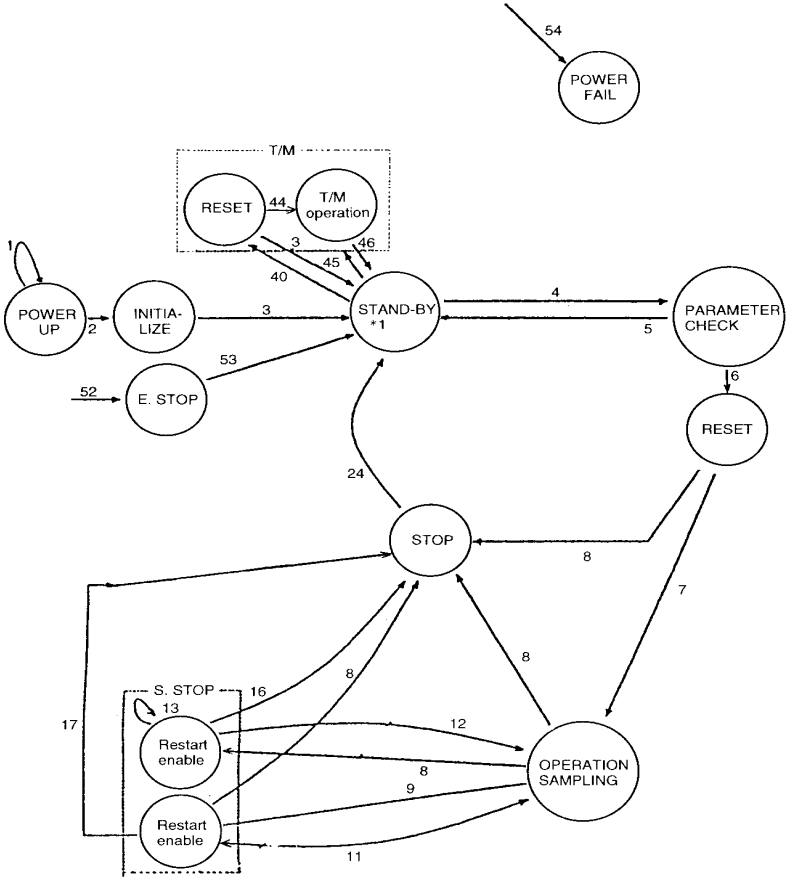
Item	Range
Abnormal control	| T - 37.0 | > 0.5 (*1)
Out of control	T > 45.0 (heater off)
Count value for reference voltage (2 V)	
Count value for reference voltage (6 V)	
ADC time-out	100 msec or more

*1: Supervised only during preparation, operation and sampling stop. The others are supervised in all statues.

- **Control**
  - **Cyclic processing system (instrument control system)**
    - **Instrument monitoring**
      - Water level
      - Temperature
      - Power-on time
      - Timer
      - Fuse
    - **Key input control**
      - START
      - S. STOP (unavailable in easy analysis mode)
      - STOP
      - T/M
      - Emergency
    - **Time chart control**
      - Scheduling
      - Channel registration
      - Sample management
      - Reaction disk
      - Sample probe
      - S. disk
      - R. probe
      - R. disk
      - Stirrer
      - ISE
      - Data processing request
      - Printer request
    - **Alarm management**
      - Alarm level updating
      - Alarm control
      - Retry management
      - Alarm for indication
      - Alarm logging
    - **Status transition control**
      - Status transition
  - **Batch processing system**
    - **TS management**
      - Routine sample
      - Control sample
      - STD sample
      - Stat sample
    - **Reagent management**
      - Remaining reagent volume management
  - **Interrupt processing system**
    - **Mechanism control**
      - S. probe down
      - R. probe down
    - **ADC control**
      - Photometry
      - ISE potential conversion
      - Photometer check
      - Cell blank measurement
      - Temperature control
    - **Barcode communication control**
      - Sample ID

7.3.1 Status Transition (routine/easy analysis

Status Transition (routine analysis mode)



No.	Transition Conditions
1	Startup error
2	Normal end of startup
3	End of initialization
4	Input of START key
7	Normal end of reset (transition to operation)
8	Input of STOP key or occurrence of STOP-level alarm
9	Input of S. STOP key, request for S. STOP (barcode reader, Pos. no. = 0, etc.)
10	Occurrence of S. STOP alarm in sampling mechanism
11	Input of START key (without reset of sampling mechanism)
12	Success in mechanism reset after input of START key (with reset of sampling mechanism)
13	Failure in mechanism reset after input of START key (with reset of sampling mechanism)
16	Completion of analysis of all samples and rinsing of all cells, input of STOP key or occurrence of STOP-level alarm
17	Completion of analysis of all samples and rinsing of all cells *2
24	End of STOP status
44	Normal end of T/M reset
45	Issuance of T/M processing (T/M without reset)
46	Automatic end of T/M processing, input of STOP key (ineffective for some T/M processings) or occurrence of STOP-level alarm
52	Occurrence of E. STOP alarm
53	End of E. STOP status
54	Occurrence of power failure

*1 In the standby status, the processings are divided between easy analysis mode and routine analysis mode on the Menu screen.

*2 T/S is not cleared. Note, however, that the stat samples are cleared after pipetting all POS samples. All the samples pipetted are referred to as "all samples".

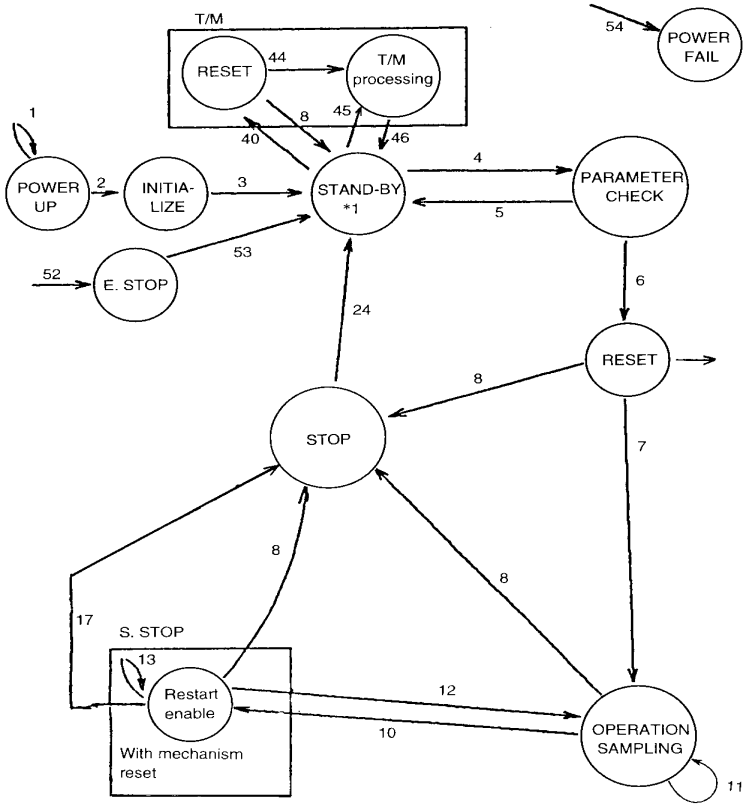
Status Transition (routine analysis mode)

No.		1	2	3	4	5	6	7	8	9	10
	Event / Status Name	Alarm					Key				Automatic End
		E. STOP	STOP	S. STOP Without Reset	S. STOP With Reset		START	S. STOP	STOP	T/M Mechanism Key	
1	Initialize	9	2 *6	—	—		—	—	—	—	2
2	Standby	—	—	—	—		3	—	—	10	—
3	Parameter check	9	2	—	—		—	—	—	—	4
4	Reset (before operation)	9	2 *4	—	—		—	—	2 *4	—	5
5	Operation (sampling)	9	8	7	8		—	7	8	—	6
6	S. stop (without reset)	9	8	—	—		5	—	8	—	8
7	S. stop (with reset)	9	8	—	—		5 *2	—	8	—	8
8	Stop	9	—	—	—		—	—	—	—	2 *3
9	Emergency stop	—	—	—	—		—	—	—	—	2
10	T/M mechanism *5	9	8	—	—		(execution) *1	—	2	—	2

*1 Used only for change of probe adjustment position. Status transition is not made.
*2 Transition is made upon achieving success in reset.
*3 In routine analysis mode, T/S information for routine samples is not cleared but stored upon transition from stop status to standby status. For stat samples, however, T/S is cleared after completion of pipetting.
*4 Transition is made after completion of reset.
*5 Photometer check, ISE check, Barcode reader check, incubator water exchange, cell blank measurement, probe adjustment, reset, mechanism check, wash and ISE prime
*6 Transition to the standby status is made upon occurrence of STOP-level alarm in reset during initialization.

7.3.1 Status Transition (easy analysis mode)

Status Transition (easy analysis mode)



No.	Transition Conditions
1	Startup error
2	Normal end of startup
3	End of initialization
4	Input of START key
5	Parameter check NG
6	Parameter check OK
7	Normal end of reset (transition to operation)
8	Input of STOP key or occurrence of STOP-level alarm
9	Request for S. STOP
10	Occurrence of S. STOP alarm in sampling mechanism
11	Input of START key (without reset of sampling mechanism)
12	Success in mechanism reset after input of START key (with reset of sampling mechanism)
13	Failure in mechanism reset after input of START key (with reset of sampling mechanism)
17	Completion of analysis of all samples and rinsing of all cells *2
24	End of STOP status
40	Issuance of T/M processing (T/M with reset)
44	Normal end of T/M reset
45	Execution of T/M processing (T/M without reset)
46	Automatic end of T/M processing, input of STOP key (ineffective for some T/M processings) or occurrence of STOP-level alarm
52	Occurrence of E. STOP alarm
53	End of E. STOP status
54	Occurrence of power failure

*1 In the standby status, the processings are divided between easy analysis mode and routine analysis mode on the Menu screen. Mode changeover is impossible during analysis.

*2 For both routine and stat samples, T/S is cleared upon transition to standby status immediately after pipetting all samples. All the samples pipetted are referred to as "all samples".

Status Transition (easy analysis mode)

No.		1	2	3	4	5	6	7	8	9	10
	Event / Status Name	Alarm				Key Input					
		E. STOP	STOP	S. STOP (with mechanism reset)	S. STOP (without mechanism reset)	START	STOP	T/M Mechanism (key input)	Automatic End		
1	Initialize	10	2 Note 5	—	—	—	—	—	2		
2	Standby	—	—	—	—	3	—	11	—		
3	Parameter check	10	2	—	—	—	—	—	4		
4	Reset (before operation)	10	2 Note 4	—	—	—	2 Note 4	—	5		
5	Operation (sampling)	10	9	8	7	—	9	—	7		
6								—			
7	Sampling stop (without reset)	10	9	—	—	5	9	—	9		
8	Sampling stop (with reset)	10	9	—	—	5 Note 2	9	—	9		
9	Stop	10	—	—	—	—	—	—	2 Note 3		
10	Emergency stop	—	—	—	—	—	—	—	2		
11	T/M mechanism *1	10	9	—	—	— Note 1	2	—	2		
12											

*1 Photometer check, ISE check, INC water exchange, cell blank, probe adjust, reset, mecha check, wash and ISE prime

NOTES:
1. Used only for change of Probe Adjust position. Status transition is not made.
2. Transition is made upon achieving success in reset.
3. For both routine and stat samples, T/S is cleared after sample pipetting.
4. Transition is made after completion of reset.
5. Transition to the standby status is made upon occurrence of STOP-level alarm in reset during initialization.

7.3.2 Scheduling when Sample Is Insufficient

(1) Outline

If insufficient sample alarm is issued three times in succession, channel registration is stopped for the subsequent tests for the relevant sample and system error is issued for empty cell. For alarm indicatiton, refer to the alarm specifications.

(2) Routine Sample

If insufficient sample alarm is issued for three tests in succession, subsequent channel registration is stopped.

(a) Channel registration is stopped for TS not yet channel-registered (waiting for channel registration) for the same sample.
(b) Channel registration is not changed when already channel-registered for the same sample.
(c) Sampling is made as scheduled when CH registration is made for other sample.
(d) The alarm "sample short" is added to the sample for which insufficient sample alarm is issued.

(3) Control Sample/Calibration Sample

Channel registration is not stopped even when insufficient sample alarm is issued for three tests in succession.

(a) The alarm "sample short" is added to the sample for which insufficient sample alarm is issued.

7.3.3 Calculation of Measurement End Time (batch processing)

(1) Outline

The expected analysis end time at scheduling timing is calculated and displayed on the screen upon input of the START key from the standby status.

(2) Basis for Calculation

The analysis end time is calculated on the basis of (a) and (b) given below.

(a) Calculation conditions
The end time is calculated by taking the samples requested at input of the START key as samples to be measured. Note that the expected time is calculated only in sample ID mode, and neither displayed not calculated in host communication mode and when there is no TS request.

MODE	HOST	End Time Display
With ID	O	×
	×	×
Sample no.	O	×
	×	O

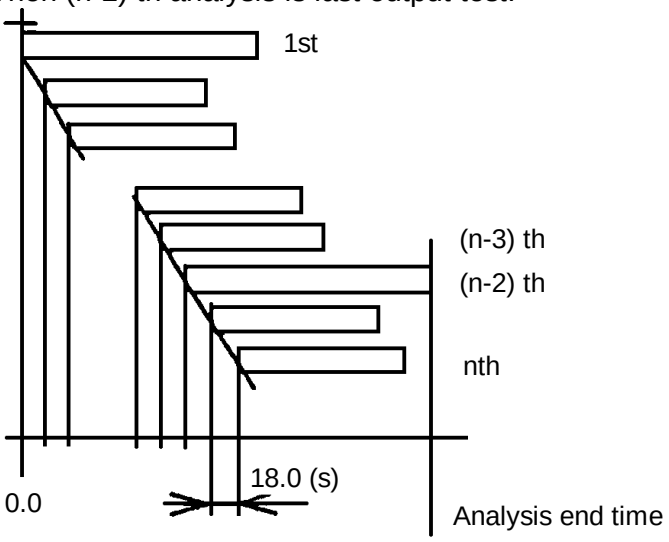
(b) Calculation equation

In channel registration to the cell, assignment is made for each test in decreasing order of analysis time. This means that the test assigned after all the others is not necessarily output last. Accordingly, the last output test is searched and the expected end time is calculated from the analysis start time and analysis time for the test.

Expected analysis end time (min) =
initialization time + start time (Note 1) + analysis time (Note 2) +
wash time required after completion of analysis

NOTES: 1. Start time: 18.0 (sec) × (number of samples up to last output test [35 samples max.] - 1)
2. Analysis time: Reaction time for last output test
(any of 10 min, 5 min, 4 min and 3 min)
3. When carryover evasion is specified:

Example: When (n-2) th analysis is last output test:



Start time = 18.0 (sec) × [(n-2) - 1]
Analysis time = Analysis time for ((n-2) th test)

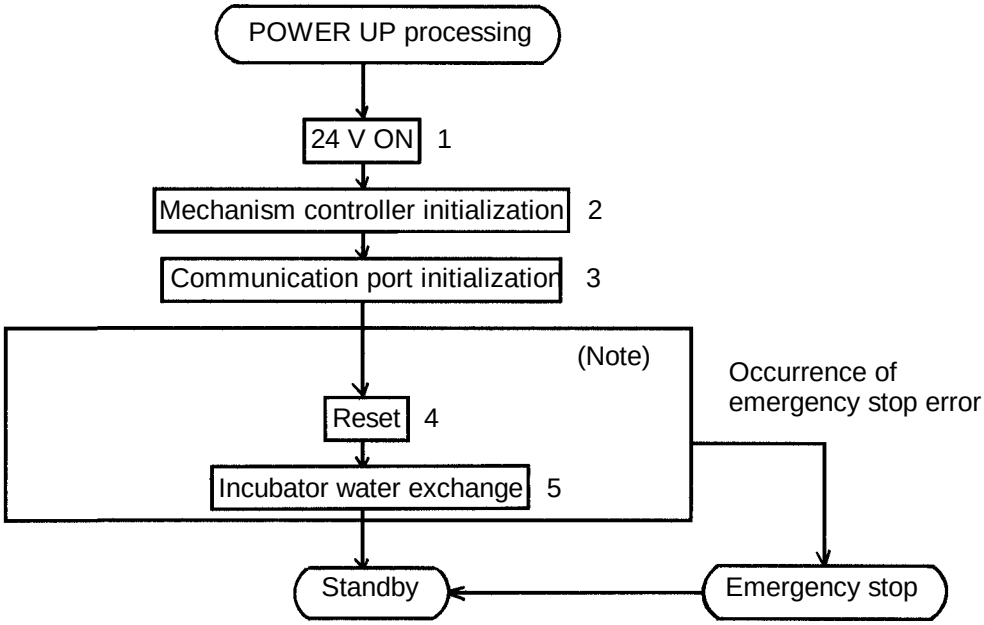
(3) Difference from Actual Analysis Time

The expected analysis end time differs from the actual one in the following cases.

(a) When unusable cell was on reaction disk (excluding execution of cell wash)
Case in which an unusable cell was found on reaction disk through cell blank check before analysis
(b) Presence/absence of test for which carry-over evasion is specified
The processing time changes when wash for carry-over evasion is carried out.
(For details, refer to the description of carry-over evasion.)
(c) Upon occurrence of insufficient sample alarm
(d) Upon occurrence of insufficient reagent alarm
(e) Upon occurrence of error related to analysis such as ID error
(f) Upon occurrence of error related to instrument

7.4 Instrument Status

7.4.1 Initialize Status



NOTE: If any reaction disk alarm is issued during reset, initialization is stopped and the standby status is established.

(1) Initialization related to analysis is completed at the end of the above flow.

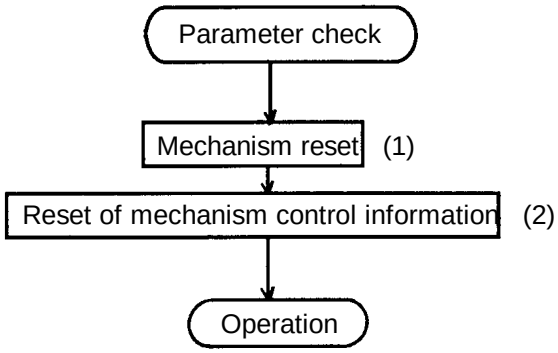
(2) For details of each processing in the numbered box in the above flow, refer the table given below.

(3) After completion of the processing in box no. 3, instrument monitoring is started periodically.

Box No.	Details of Processing
1	Waiting for 500 msec after turning on 24 V
2	CPCNT, CMCNT initialization
3	Initialization of communication ports excluding S I/F port (for 6 channels)
4	Refer to the time chart specifications.
5	Same as above

7.4.2 Reset Status

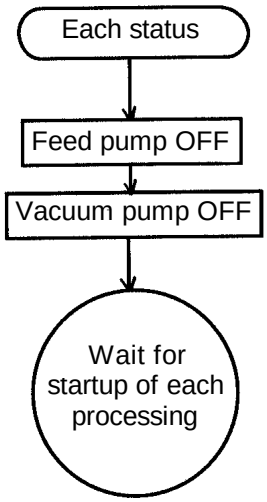
Reset Status



(1) Refer to the description of mechanism reset in the T/M reset flow.

(2) Mechanism control information includes the following.
1) Sample disk mechanism control information
2) Sample pipetting mechanism control information
3) Reaction disk mechanism control information
4) Cell rinse mechanism control information
5) Cell stirring mechanism control information
6) Reagent disk mechanism control information
7) Reagent pipetting mechanism control information
8) ISE measurement mechanism control information

7.4.3 Standby Status

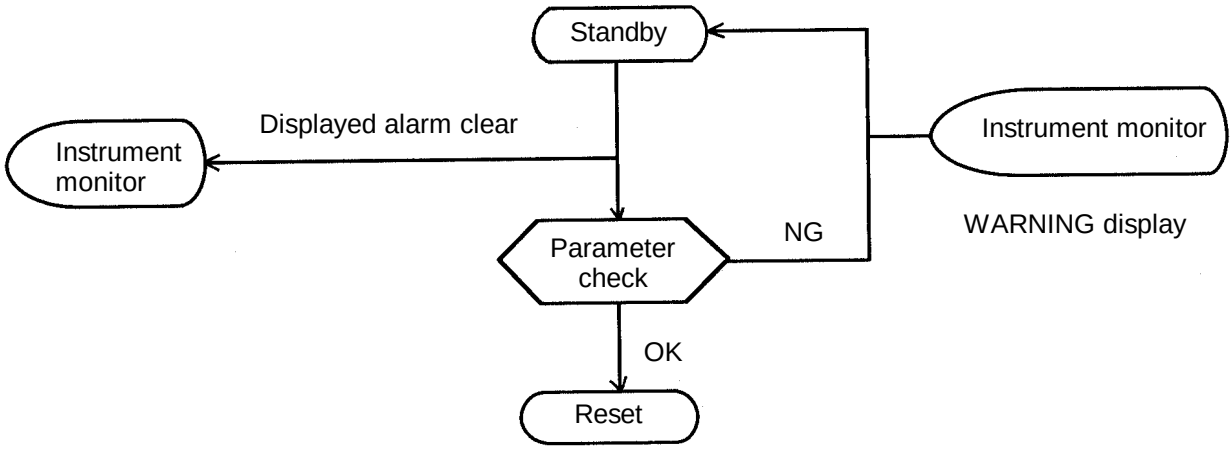


(1) If the water level in the incubator drops, the feed pump and SV4 are turned on for 1 second.

(2) The incubator pump and light source lamp remain turned on.

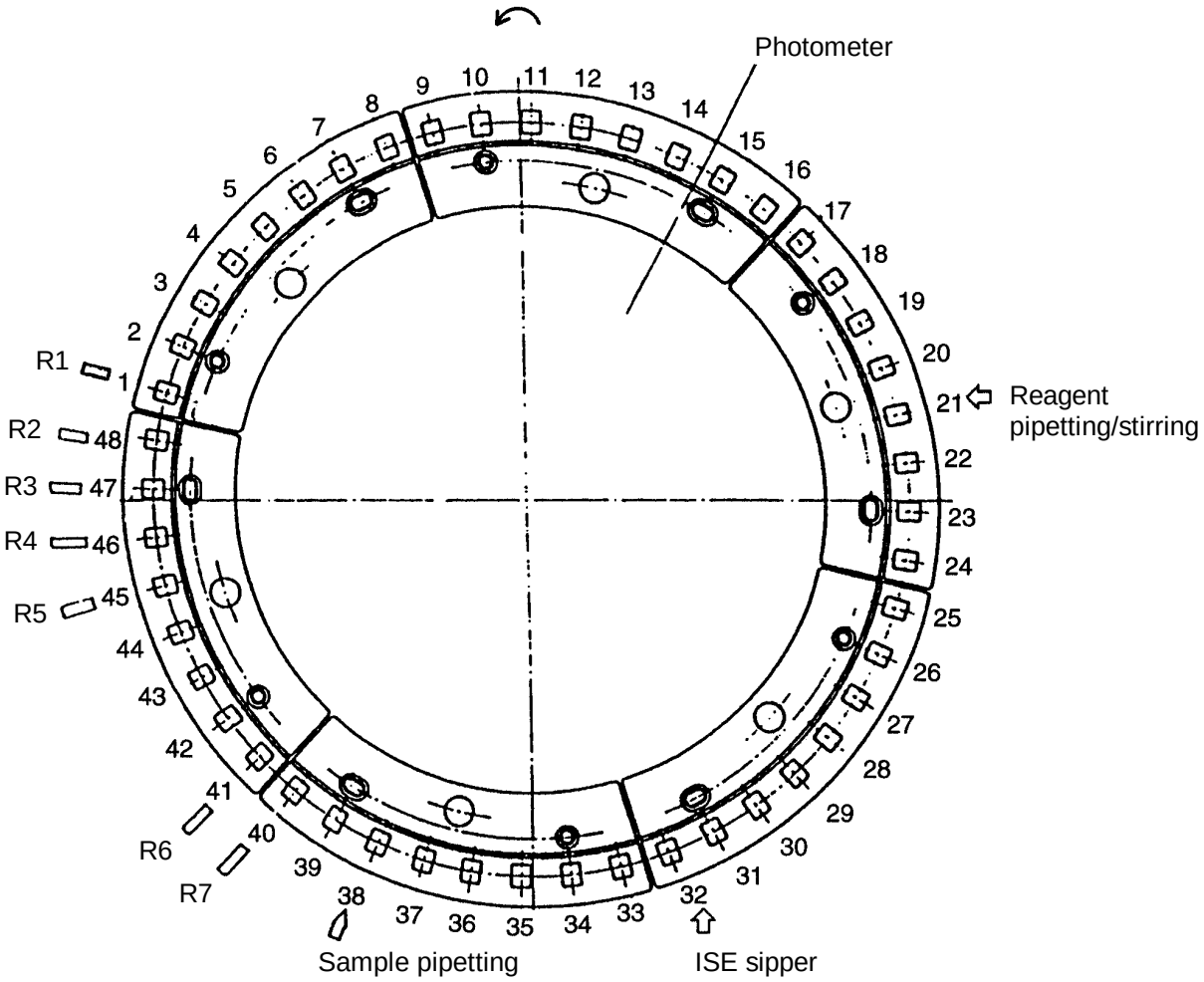
(3) Incubator temperature control is made.

Parameter Check



For details of parameter check, refer to the specifications of data processing functions.

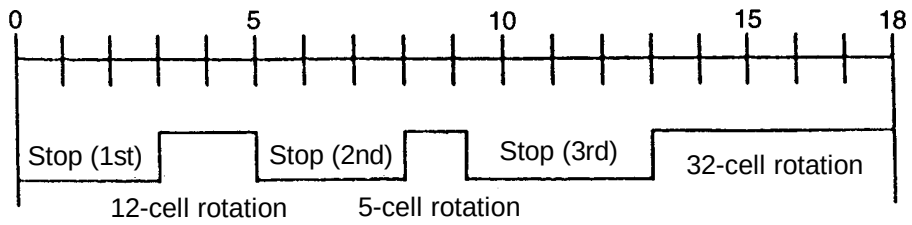
7.4.4 Operation (reaction disk)



The reaction disk accommodates forty-eight reaction cells.

The reaction disk rotates by one revolution + one cell (= 49 cells) in one cycle (= 18 sec).

The rotation/stop timing in one cycle is as follows.



Operation (photometry assay)

- Relationship between 48 Cells Measured in 1 Cycle, Photometric Sequence and 10-minute Reaction Measurement Sequence

R. Disk Rotation	12-cell Rotation	5-cell Rotation	32-cell Rotation
Measurement sequence	1 2 3 4 5 6 7 8 9 10 11 12	13 14 15 16 17	18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49
POS # before measurement	15 16 17 18 19 20 21 22 23 24 25 26	27 28 29 30 31	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
POS # after measurement	14 15 16 17 18 19 20 21 22 23 24 25	26 27 28 29 30	31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 1 2 3 4 5 6 7 8 9 10 11 12 13 14
Photometric point	E24 E22 E20 E18 E16 E14 E23 E21 E19 E17 E15 E13	E12 E10 E8 E11 E9	E6 E4 E2 R10 R8 CB3 CB1 R6 R4 R2 E35 E53 E31 E29 E27 E25 E7 E5 E3 E1 R9 CB4 CB2 R7 R5 R3 R1 E34 E32 E30 E28 E26
λ 1 λ 2	Wavelength set by analytical parameter		

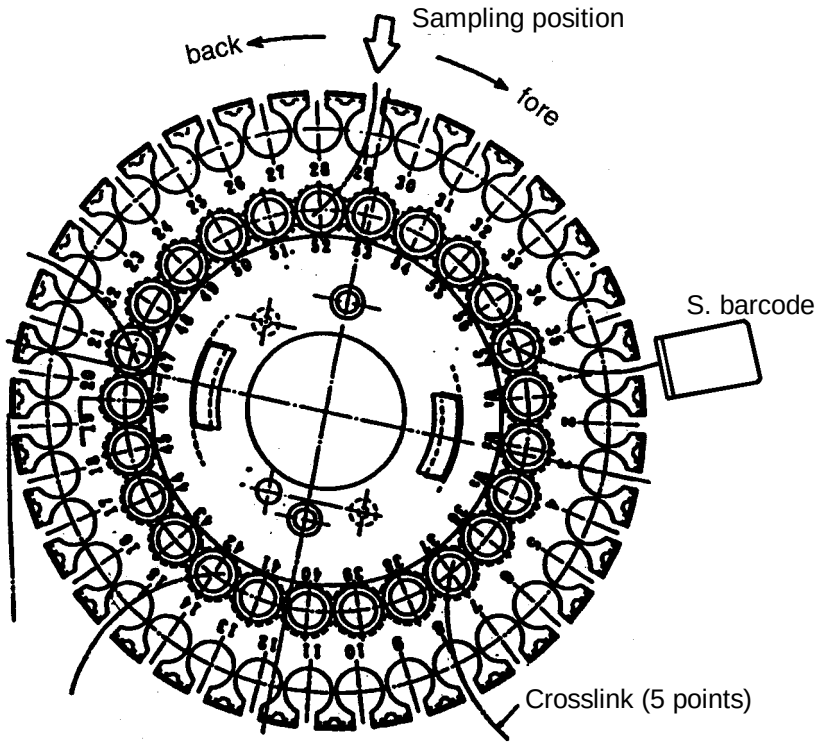
Explanation of Photometric Point

CB1 to CB4 : Passing cell blank
E1 to E35 : Routine

Abnormality in measurement causes occurrence of PHOTOMETER LAMP or other alarm. For details of alarm, refer to the alarm specifications.

R1 to R10 : Invalid data

Operatiton (sample disk)



(sample disk stop position at reset)

Outer track :.....35 positions For routine and stat samples
Inner track : 25 positions.....For control serum, standard solution, detergent (W1, W2, W3)
(position-free except detergent)

(1) Definition of Control Variable

Represented by optional position POS # (x, y) on the S. disk.
- x: Track variable (1: outer track, 2: inner track)
- y: Position variable (1 to 35: outer track, 1 to 25: inner track)

(2) Rotation Control System

In rotation from POS #1 (x, y) to POS #2 (x', y'), the sample disk stops at position POS2-1 (x'-1, y'-1), is fed 1 pitch (back) and stops the next position (sampling position).

(a) x = x' fore : θ (back) $\geq \theta$ (fore)
back : θ (back) $< \theta$ (fore)

(b) x = x' The sample disk rotates in order of POS #N (x, y) $\rightarrow$ POS #N (n, m) (nearby intermediary position in direction determined in (1)) $\rightarrow$ POS #2 (x'-1, y'-1) $\rightarrow$ POS #2 (x', y').
The direction of rotation is determined in the same manner as in (1). Note that the sample disk moves back when POS #N (n, m) is ahead of POS #2-1 (x'-1, y'-1) in the above direction of rotation.

NOTE: θ is an angle between the current position and one position before the destination.

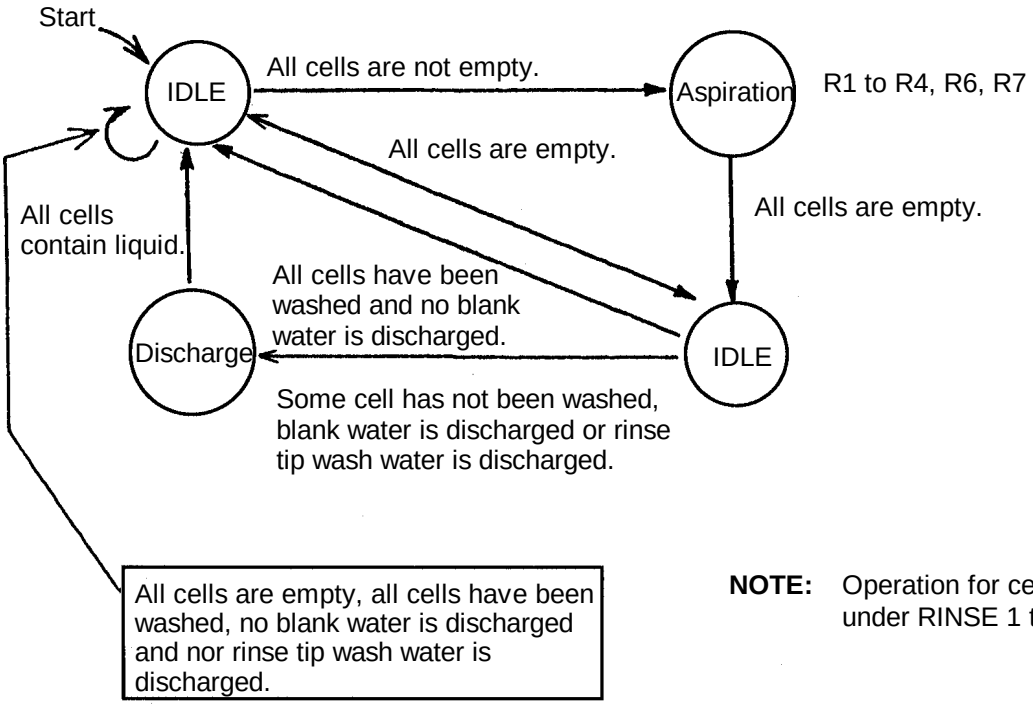
For rotation and stop in one cycle, refer to the following page.

Operation (cell rinse mechanism)

(1) Function

Reaction cell rinse (wash with water 5 times including cell blank water)

(2) Status Transition for Cell Rinse


Start
IDLE
All cells are not empty.
Aspiration
R1 to R4, R6, R7
All cells are empty.
All cells are empty.
All cells contain liquid.
All cells have been washed and no blank water is discharged.
Discharge
IDLE
Some cell has not been washed, blank water is discharged or rinse tip wash water is discharged.
All cells are empty, all cells have been washed, no blank water is discharged and nor rinse tip wash water is discharged.

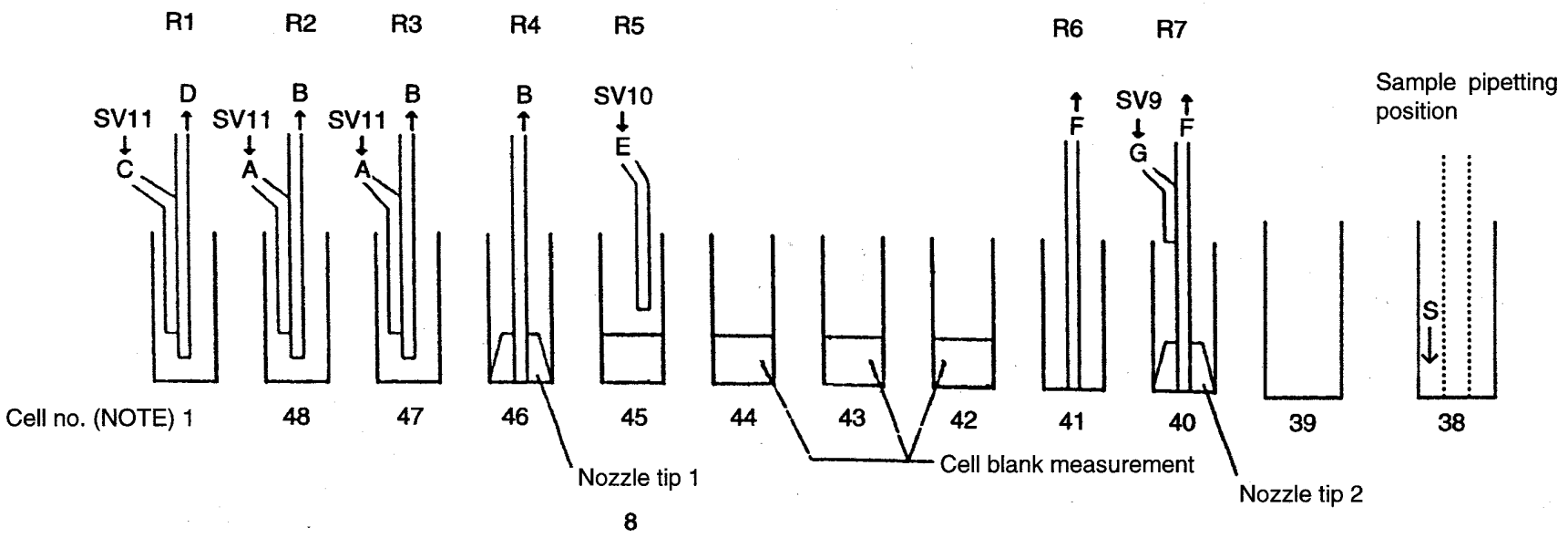
NOTE: Operation for cells located under RINSE 1 to 7

(3) Discharge of Cell Blank Water

Cell blank water is discharged in the operation status and sampling stop status. Note, however, that discharge and measurement are not made in two cycles after start from the standby status.

(4) Rinse Tip Wash

The rinse tip (R7) is washed over cycle 3 to 9 immediately after start of operation. (while cell no. 1 shifts from R3 to R6)



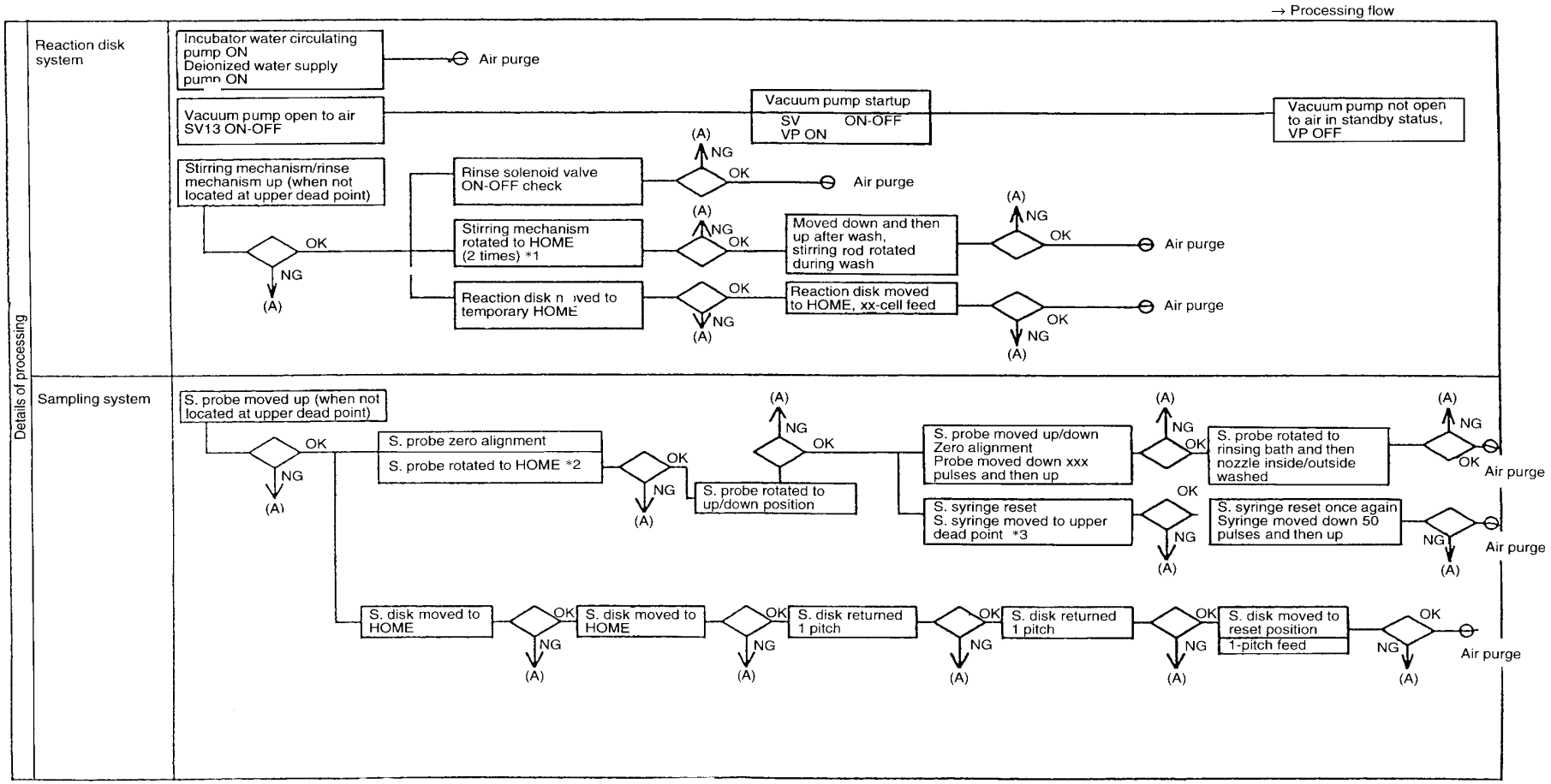
A : For discharge of purified water
B : For aspiration of rinse water
C : For discharge of purified water
D : For aspiration of reacting solution
E : For discharge of purified water for cell blank measurement
F : For aspiration of purified water for cell blank measurement
G : For discharge of purified water (cycle x to x immediately after start of analysis)

NOTE: Cell no. indicates the number when the reaction disk is located at reset position.

7.5 Maintenance Functions

7.5.1 Reset

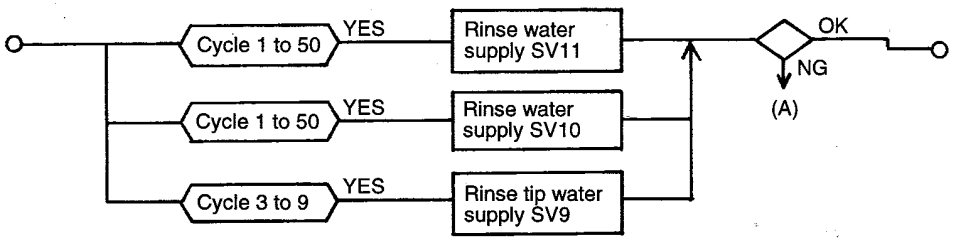
Details of Reset


→ Processing flow
Details of processing
Reaction disk system
Incubator water circulating pump ON
Deionized water supply pump ON
Air purge
Vacuum pump open to air SV13 ON-OFF
Vacuum pump startup
SV ON-OFF
VP ON
Vacuum pump not open to air in standby status, VP OFF
Stirring mechanism/rinse mechanism up (when not located at upper dead point)
OK
NG
(A)
Rinse solenoid valve ON-OFF check
Air purge
Stirring mechanism rotated to HOME (2 times) *1
Moved down and then up after wash, stirring rod rotated during wash
Reaction disk n ved to temporary HOME
Reaction disk moved to HOME, xx-cell feed
Sampling system
S. probe moved up (when not located at upper dead point)
S. probe zero alignment
S. probe rotated to HOME *2
S. probe rotated to up/down position
S. probe moved up/down Zero alignment Probe moved down xxx pulses and then up
S. probe rotated to rinsing bath and then nozzle inside/outside washed
S. syringe reset S. syringe moved to upper dead point *3
S. syringe reset once again Syringe moved down 50 pulses and then up
S. disk moved to HOME
S. disk moved to HOME
S. disk returned 1 pitch
S. disk returned 1 pitch
S. disk moved to reset position 1-pitch feed

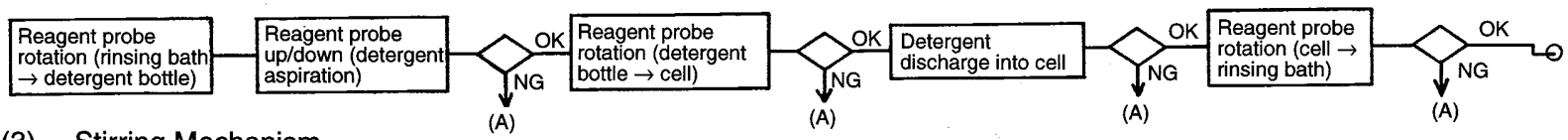
*1 Deviated from HOME when located at HOME.
*2 Deviated from HOME and then moved to HOME if located at HOME.
*3 Deviated from upper dead point and then moved to upper dead point when located at upper dead point.

7.5.2 Wash

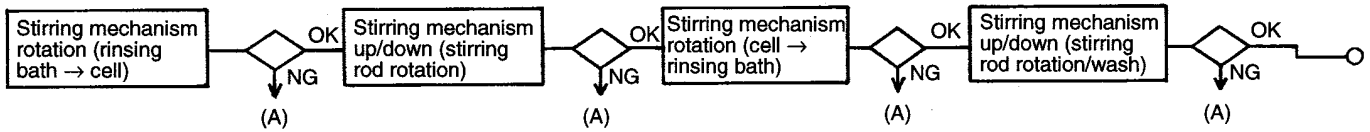
(1) Rinse Mechanism



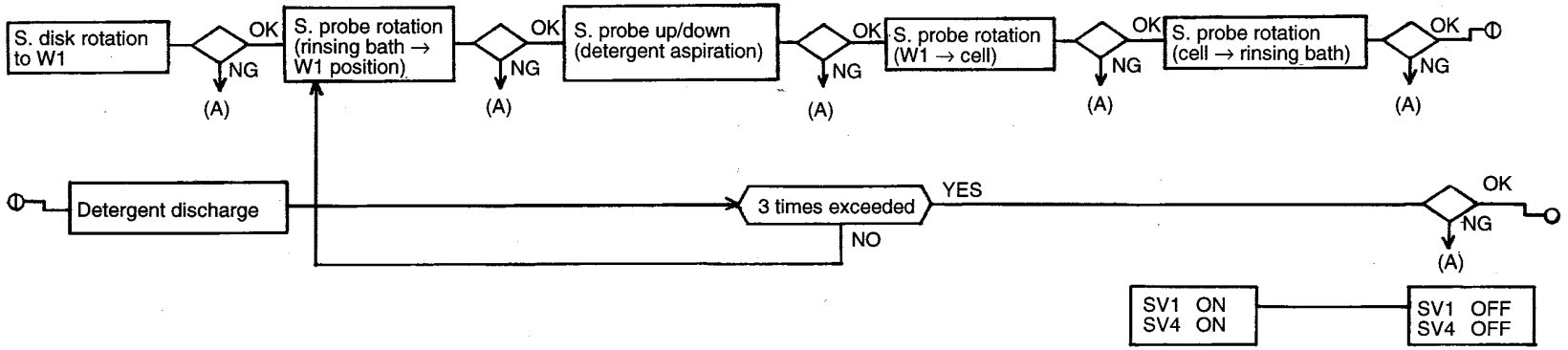
(2) R. Probe Mechanism



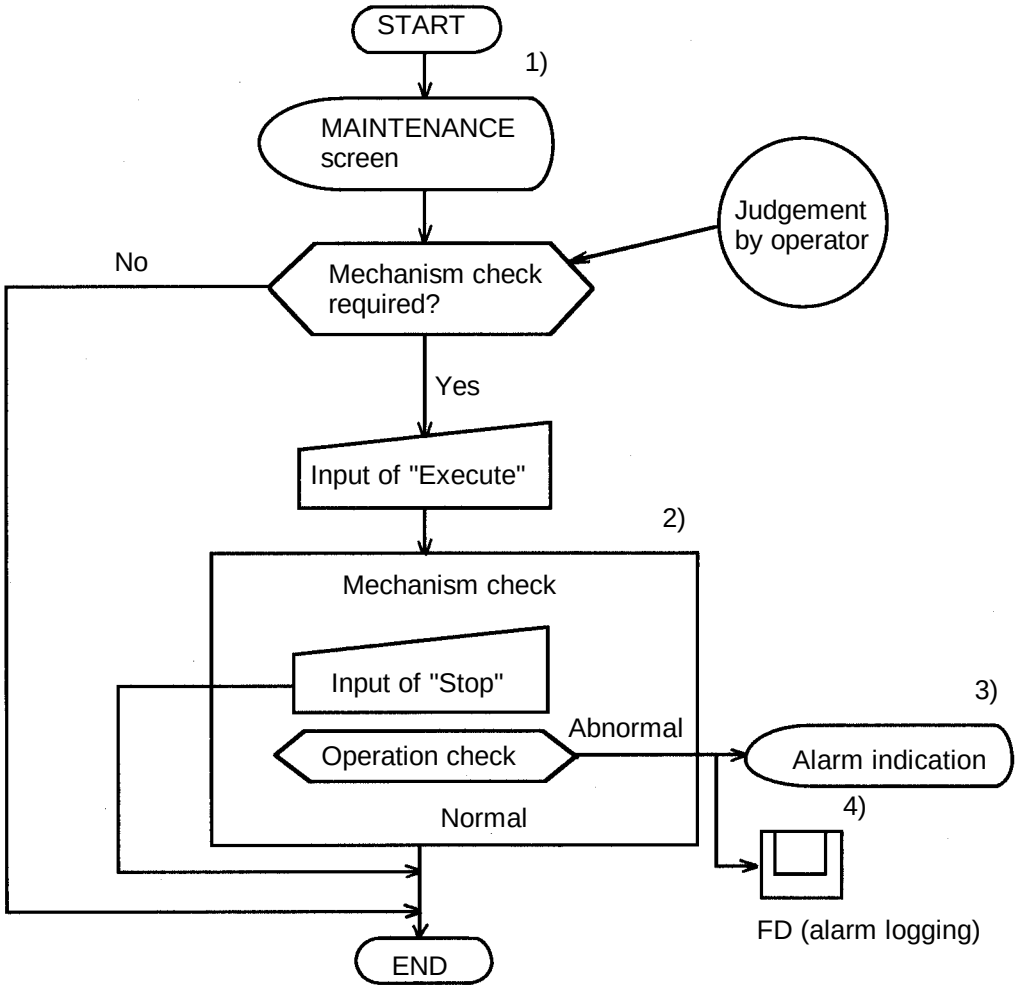
(3) Stirring Mechanism



(4) Sampling Mechanism



7.5.3 Mechanism Check



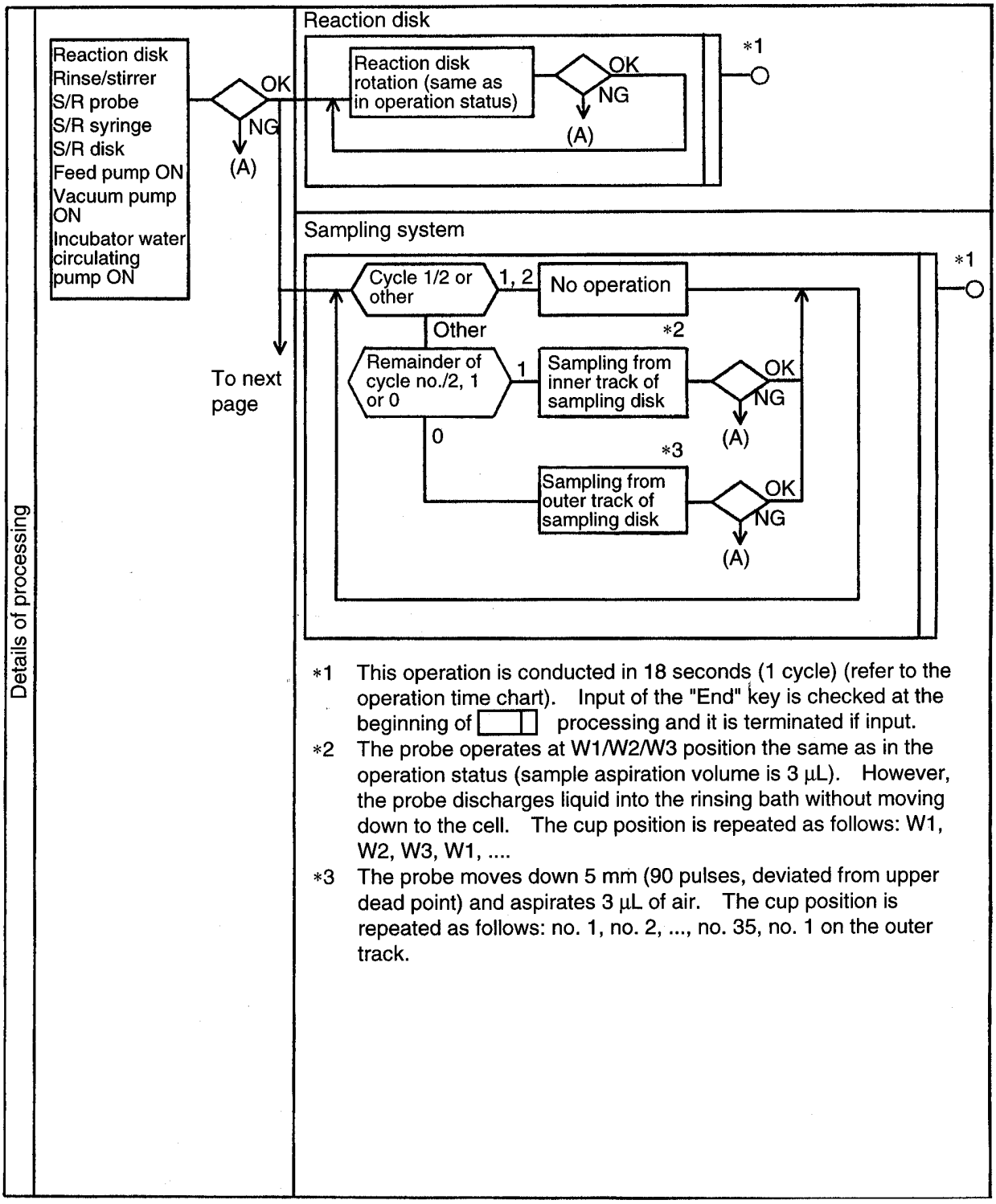
Function : The reaction disk, sampling system, reagent dispensing system, cell rinse system, stirring system and ISE system are made to operate the same as in the operation status.

Required time : Reset 20 sec + mechanism check 18 sec/cycle × X times

Processing No.	Details of Processing	Reference Document
1)	Start from MAINTENANCE screen	Screen specifications
2)	Refer to the following page.	
3)	At mechanism check, operation is checked and alarm is displayed on the instrument monitor screen if operation is abnormal.	Screen specifications Alarm code table
4)	The above alarm is stored in FD.	FD specifications

Remarks: Operation is repeated until the End key is input.

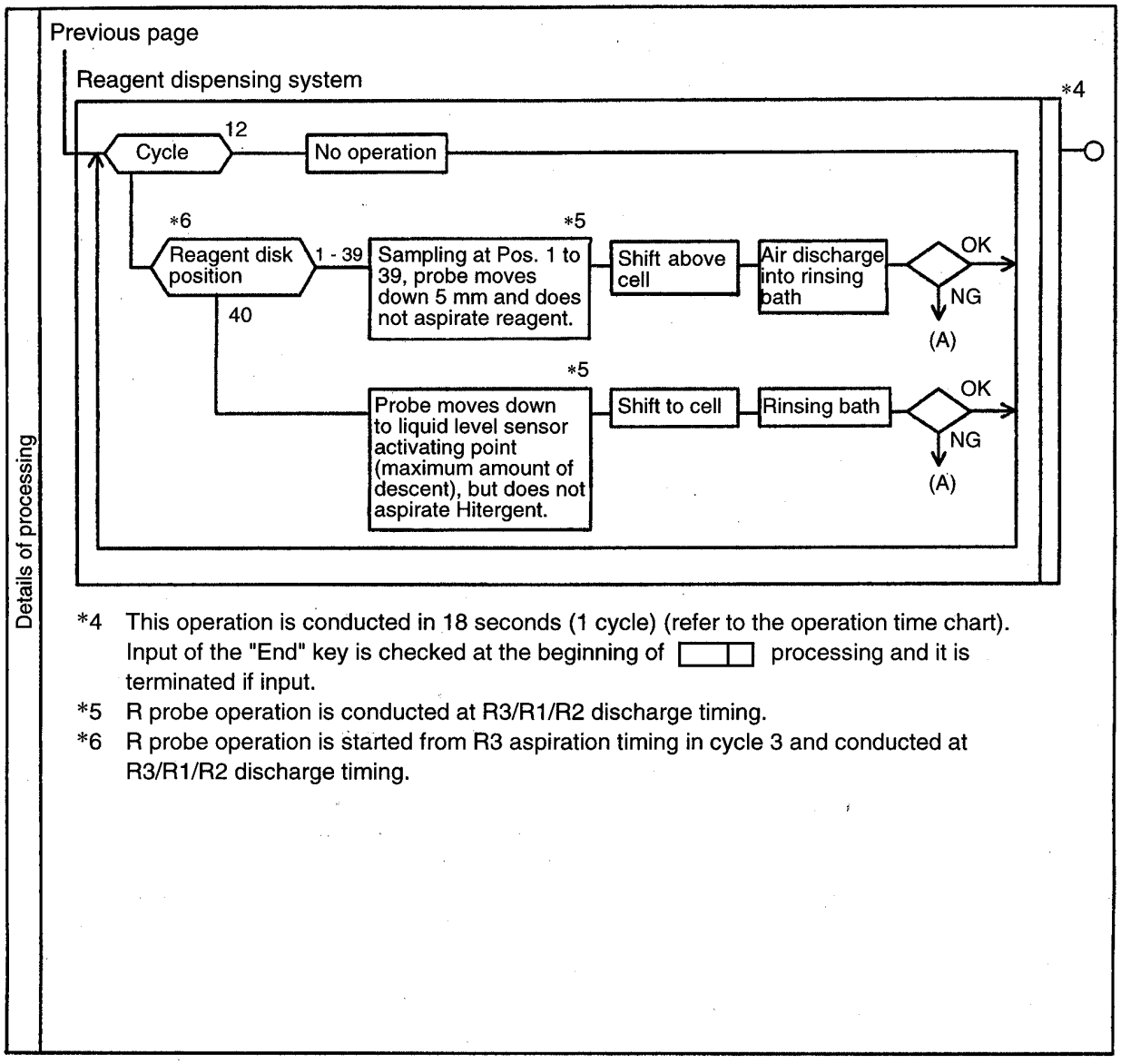
Details of Mechanism Check



*1 This operation is conducted in 18 seconds (1 cycle) (refer to the operation time chart). Input of the "End" key is checked at the beginning of [ ] processing and it is terminated if input.

*2 The probe operates at W1/W2/W3 position the same as in the operation status (sample aspiration volume is 3 µL). However, the probe discharges liquid into the rinsing bath without moving down to the cell. The cup position is repeated as follows: W1, W2, W3, W1, ...

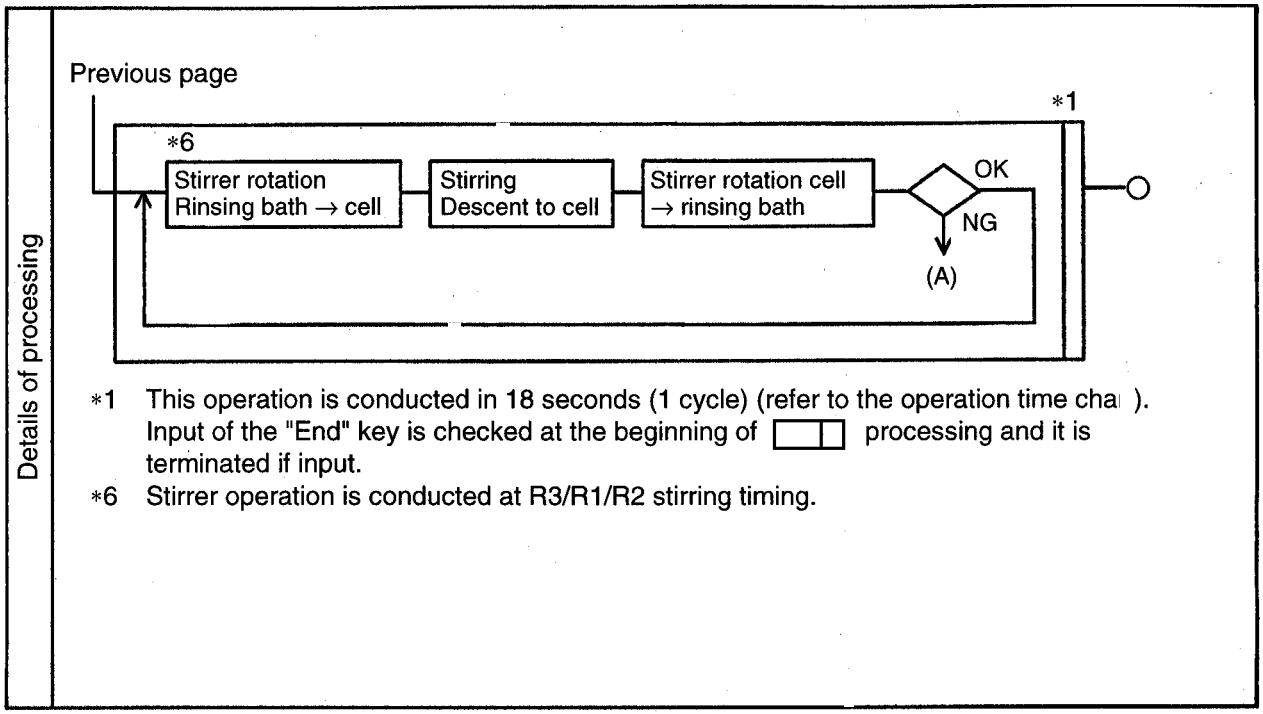
*3 The probe moves down 5 mm (90 pulses, deviated from upper dead point) and aspirates 3 µL of air. The cup position is repeated as follows: no. 1, no. 2, ..., no. 35, no. 1 on the outer track.



*4 This operation is conducted in 18 seconds (1 cycle) (refer to the operation time chart). Input of the "End" key is checked at the beginning of ☐☐ processing and it is terminated if input.

*5 R probe operation is conducted at R3/R1/R2 discharge timing.

*6 R probe operation is started from R3 aspiration timing in cycle 3 and conducted at R3/R1/R2 discharge timing.

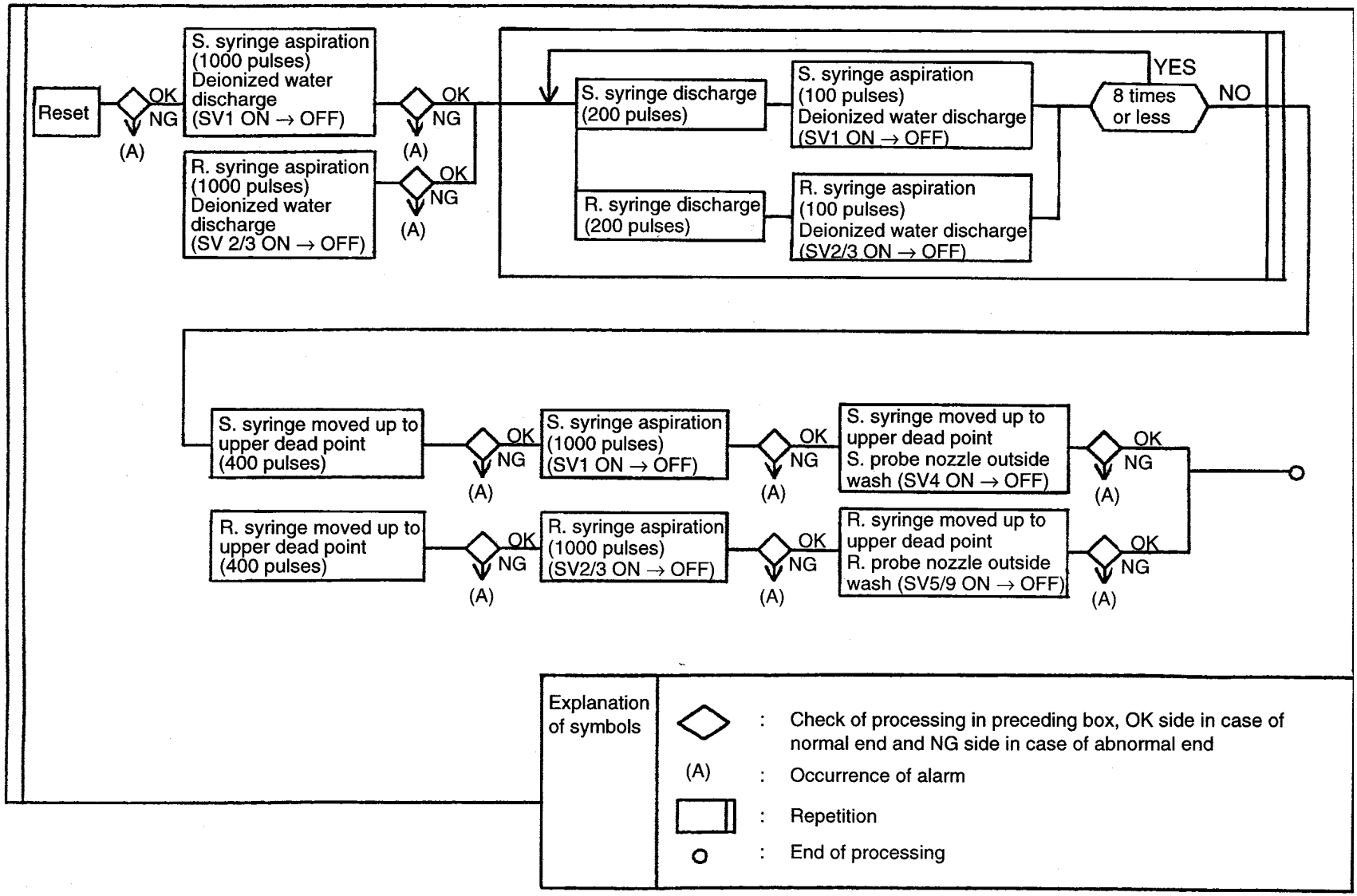


*1 This operation is conducted in 18 seconds (1 cycle) (refer to the operation time cha).
Input of the "End" key is checked at the beginning of ▭▯ processing and it is terminated if input.

*6 Stirrer operation is conducted at R3/R1/R2 stirring timing.

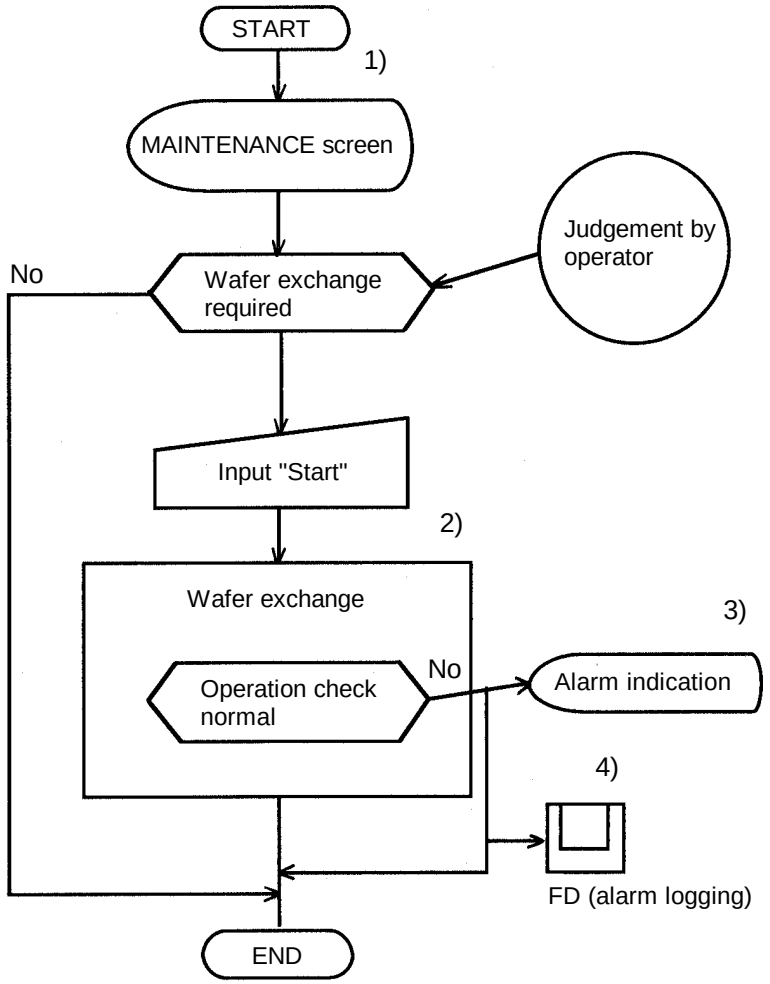
7.5.4 Air Purge

Air Purge


Reset
OK
NG
(A)
S. syringe aspiration (1000 pulses) Deionized water discharge (SV1 ON → OFF)
R. syringe aspiration (1000 pulses) Deionized water discharge (SV 2/3 ON → OFF)
S. syringe discharge (200 pulses)
R. syringe discharge (200 pulses)
S. syringe aspiration (100 pulses) Deionized water discharge (SV1 ON → OFF)
R. syringe aspiration (100 pulses) Deionized water discharge (SV2/3 ON → OFF)
YES
NO
8 times or less
S. syringe moved up to upper dead point (400 pulses)
R. syringe moved up to upper dead point (400 pulses)
S. syringe aspiration (1000 pulses) (SV1 ON → OFF)
R. syringe aspiration (1000 pulses) (SV2/3 ON → OFF)
S. syringe moved up to upper dead point S. probe nozzle outside wash (SV4 ON → OFF)
R. syringe moved up to upper dead point R. probe nozzle outside wash (SV5/9 ON → OFF)
Explanation of symbols
: Check of processing in preceding box, OK side in case of normal end and NG side in case of abnormal end
(A) : Occurrence of alarm
: Repetition
: End of processing

7.5.5 Incubator Water Exchange

Incubator Water Exchange



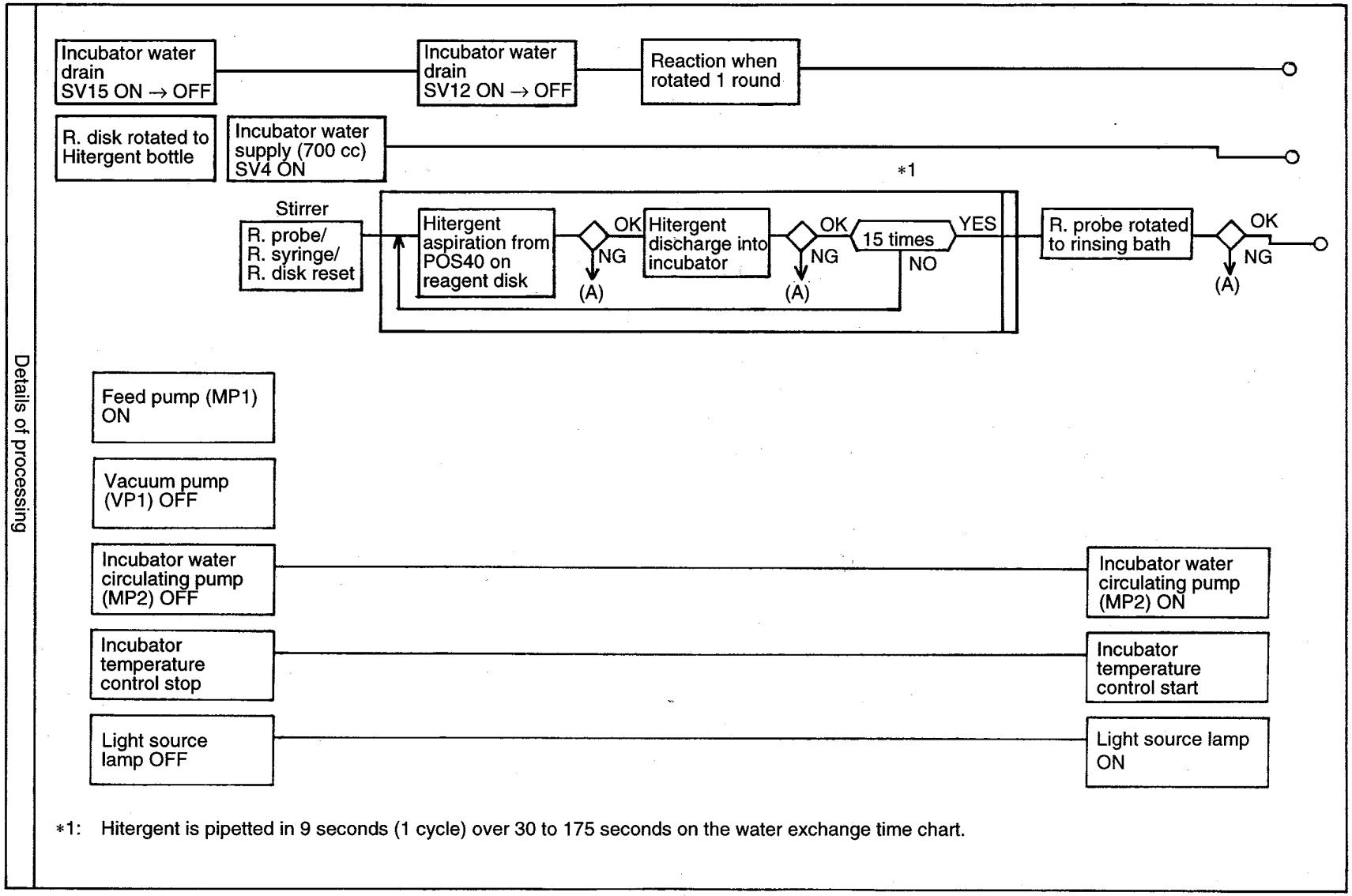
Function : Incubator water is exchanged twice and Hitergent is injected.
Required time : 210 sec

Processing No.	Details of Processing	Reference Document
1)	Start from MAINTENANCE screen	Screen specifications
2)	Refer to the following page.	
3) 4)	At water exchange, operation check is conducted and alarm is displayed if operation is abnormal. The alarm is stored in FD.	Screen specifications Alarm code table FD specifications

Remarks: 1. Incubator water drain
Drain with solenoid valve

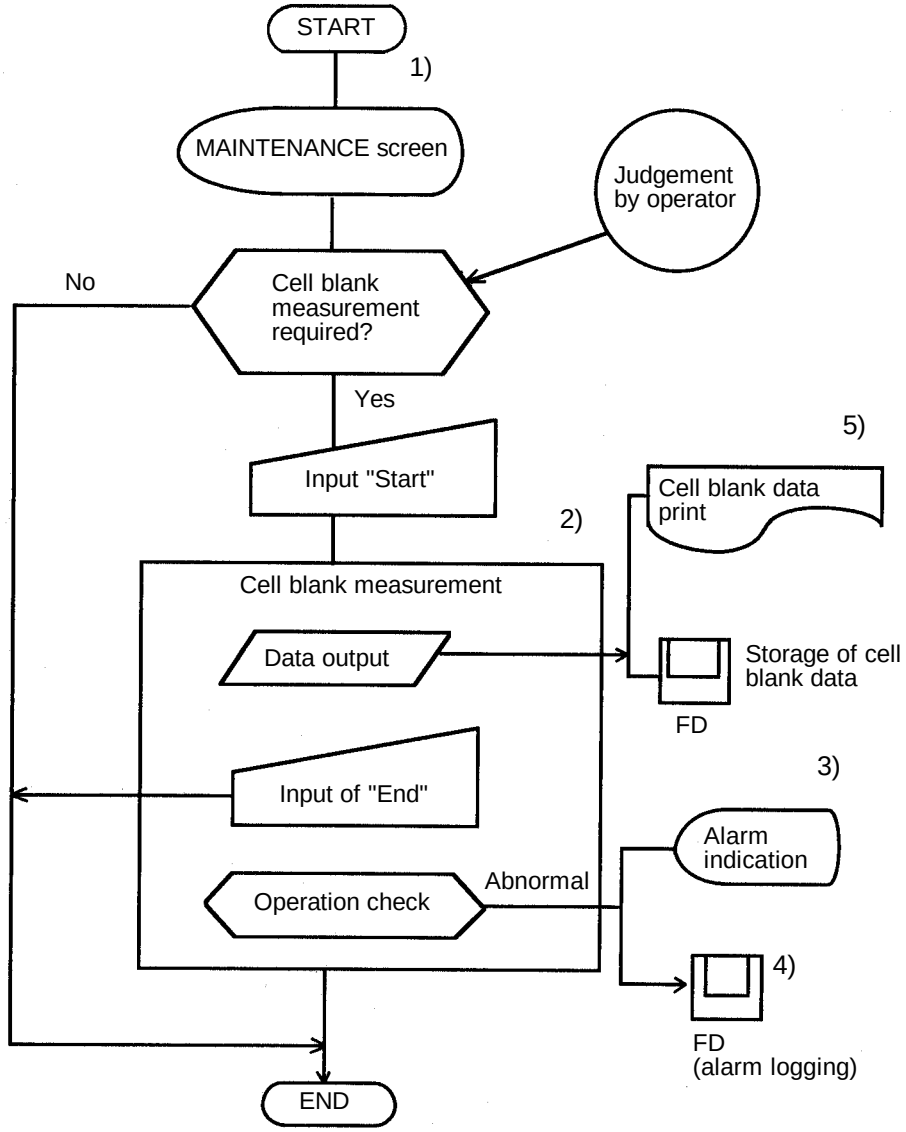
2. Addition of Hitergent
After execution of water exchange, undiluted Hitergent is injected with the reagent probe into the incubator (550 μL/time × 15 = 8.25 cc).

Details of Incubator Water Exchange



*1: Hitergent is pipetted in 9 seconds (1 cycle) over 30 to 175 seconds on the water exchange time chart.

7.5.6 Cell Blank

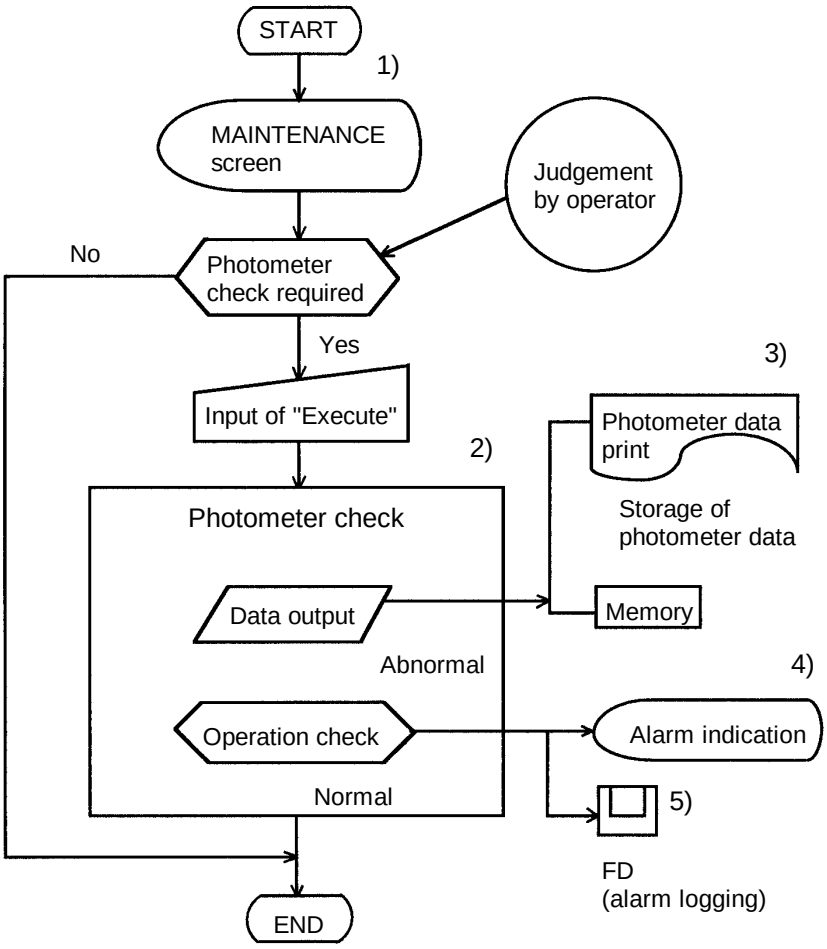


Function : The cell blank value is measured for all cells (48 cells).
Required time : 10 min 24 sec (reset 20 sec + 12 sec/cycle × 52 cycles)

Processing No.	Details of Processing	Reference Document
1)	Start from MAINTENANCE screen	Screen specifications
2)	Refer to the next page.	
3)	At cell blank measurement, operation is checked and alarm is displayed if operation is abnormal.	Screen specifications Alarm code specifications
4)	The above alarm is stored in FD.	
5)	Raw abbsorbance values and difference data for all cells (48 cells) are printed on the report and all raw absorbance values are saved in FD.	Report specifications FD specifications

Remarks

7.5.7 Photometer Check



Function : Absorbances at 12 wavelengths are measured and output onto the p rinter together with the previously measured data.

Required time : 1 min 50 sec (reset 20 sec + 18 sec/cycle × 5 cycles)

Processing No.	Details of Processing	Reference Document
1)	Start from MAINTENANCE screen	Screen specifications
2)	Refer to the next page.	
3)	Absorbances at 12 wavelengths (main/sub) are printed out together with previous ones stored in CRAM. The recent result data is stored in CRAM.	Photometer report data check
4)	At execution of photometer check, operation is checked and alarm is displayed if operation is abnormal.	Screen specifications Alarm code specifications
5)	The above alarm is stored in FD.	FD specifications

Remarks

(1) Precision Check

(a) Statitical calculation is made for the result data of routine samples.

(b) Specify Precision Check on the MAINTENANCE screen.

(c) Statistical data for a maximum number of samples is calculated. Up to forty tests including ISE assay are applicable.

(d) The statistical data shown in the following table is output.

Output Statistical Data	Output Format	Number of Digits below Decimal Point
Data Count (N)	3-digit integral	–
Maximum value (MAX)	6-digit real number with sign/decimal point	According to STD(1) CONC
Minimum value (MIN)	Same as above	Same as above
Mean value (MEAN)	7-digit real number with sign/decimal poin	1 digit increased below decimal point as compared with STD(1) CONC
Standard deviation (SD)	Same as above	Same as above
Coefficient of variation (CV)	6-digit real number with decimal point	Fixed at 2 digits

(e) The result data is read from FD.

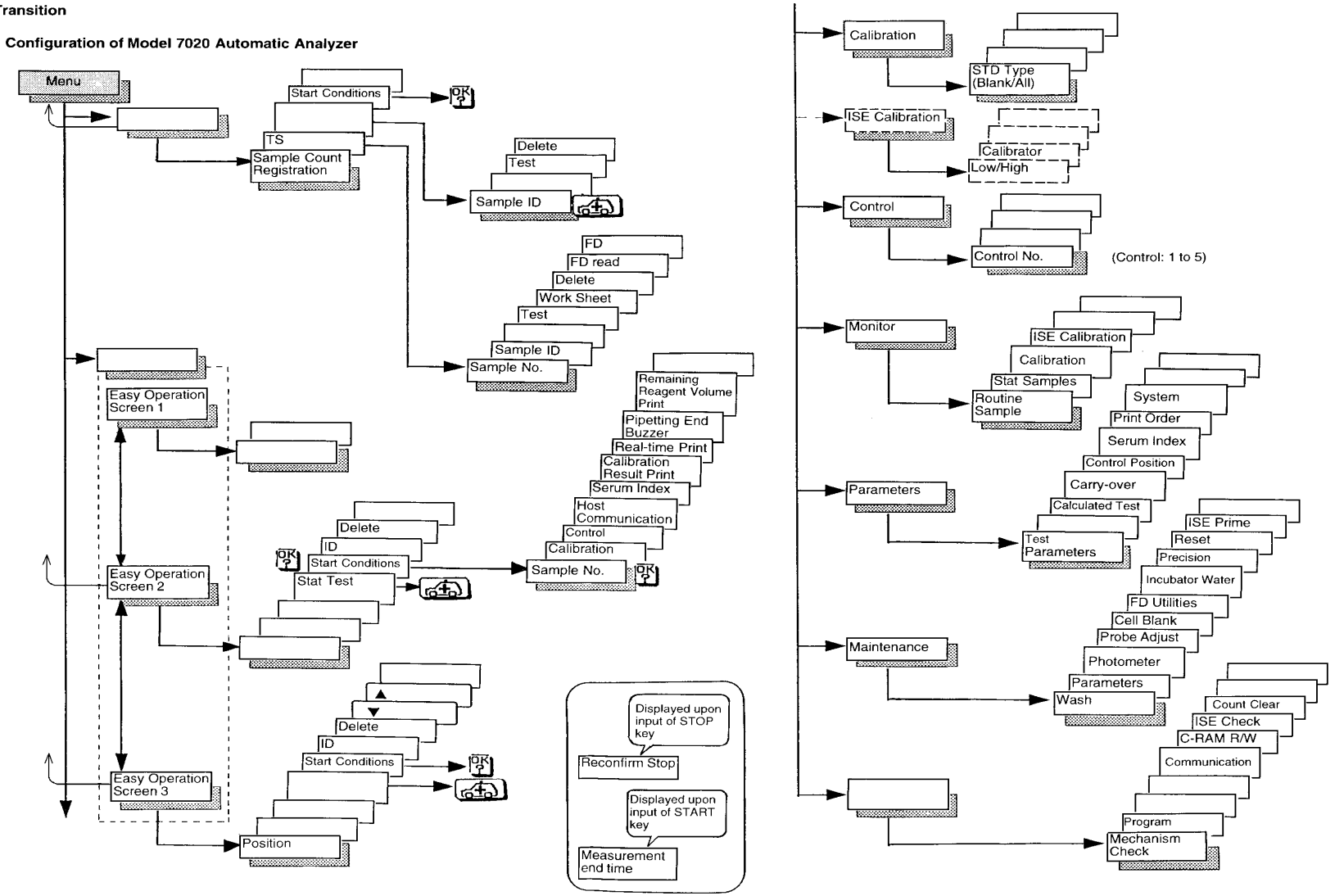
(f) The result data provided with an alarm is excluded from calculation (also not counted for N). Note that reference value range over and overflow are excluded from alarm.

(g) Statistics are not output for unmeasured tests and subsequent tests are placed close.

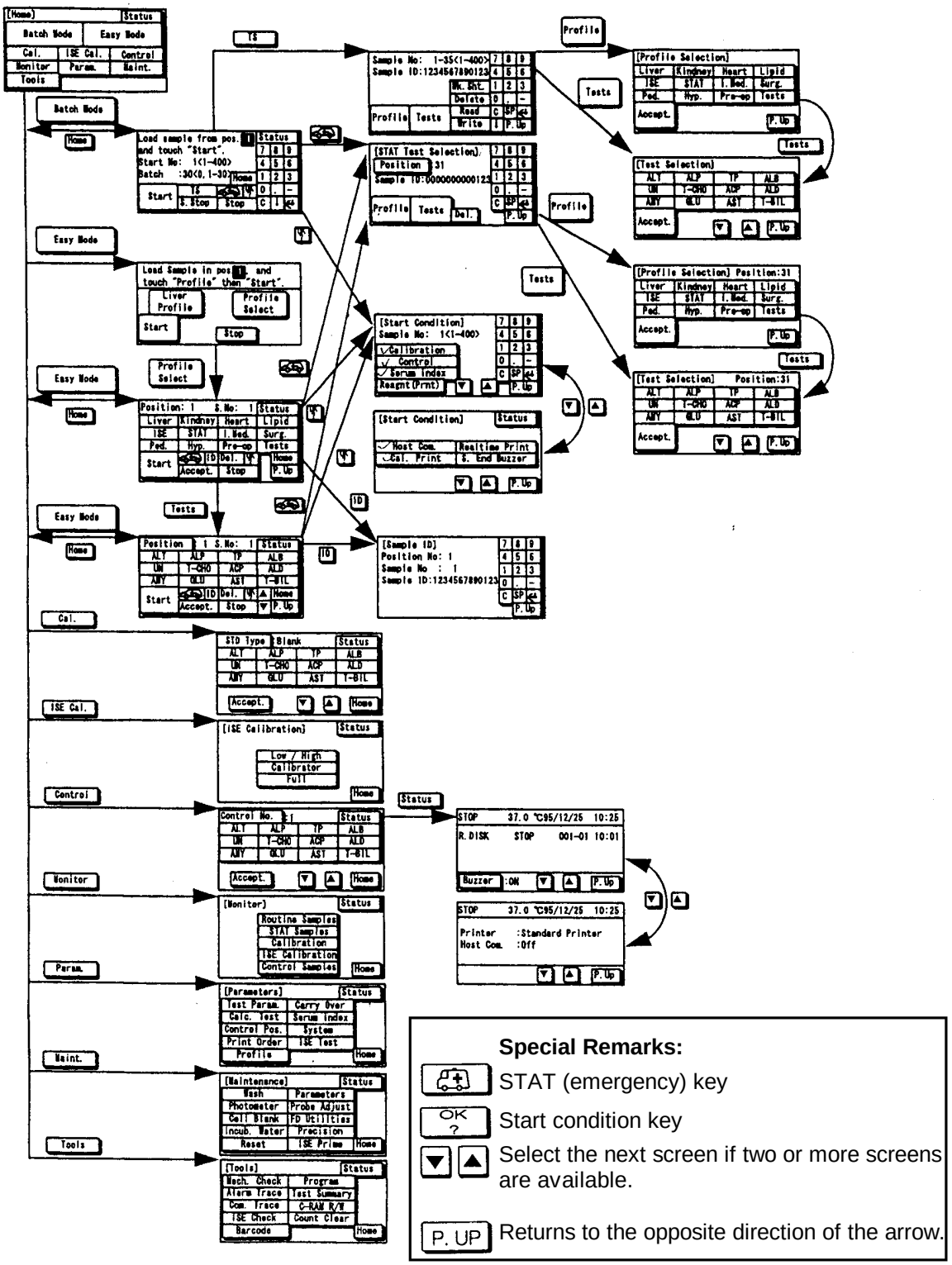
(h) When N < 2, statistical calculation is not carried out.

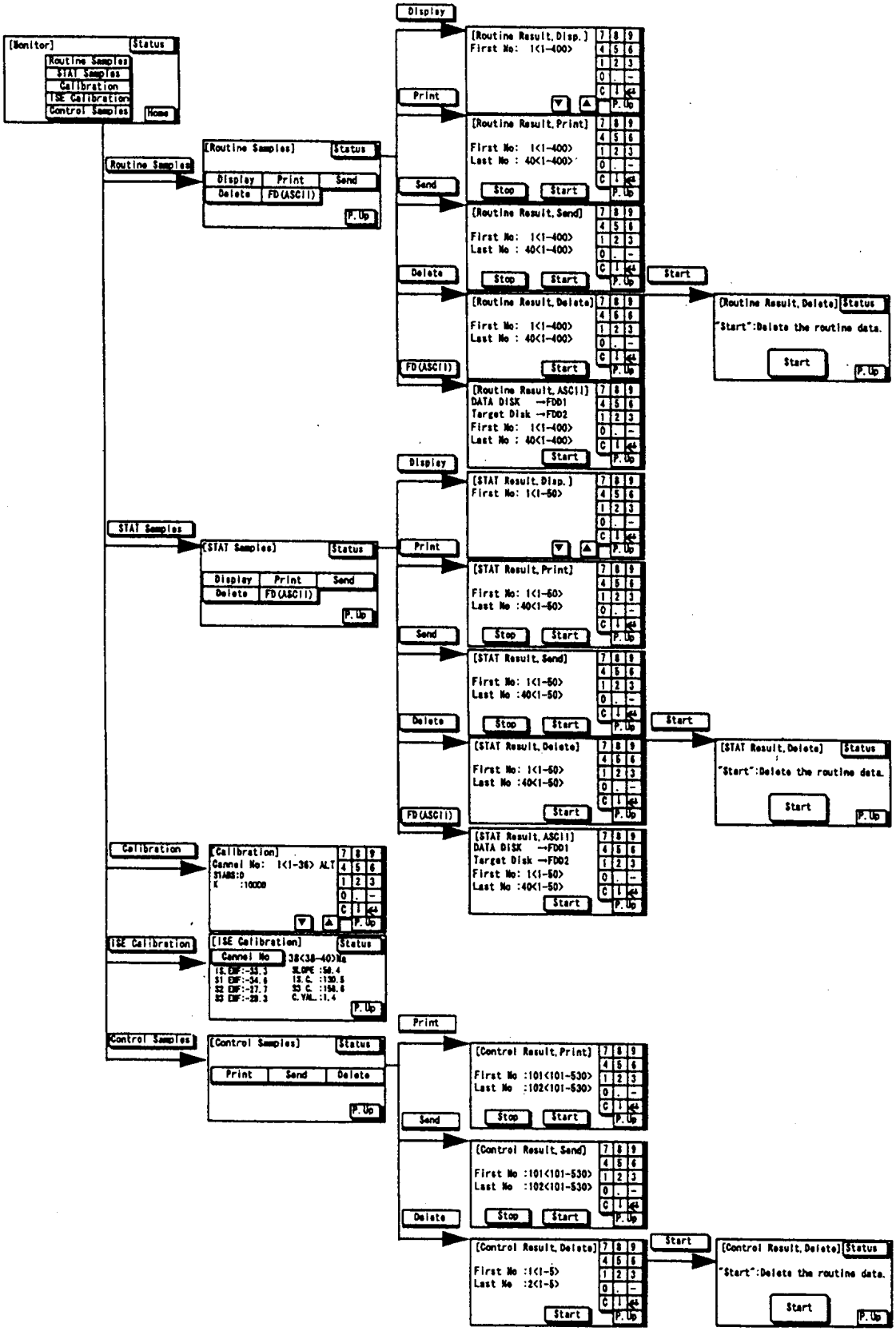
7.6 Screen Transition

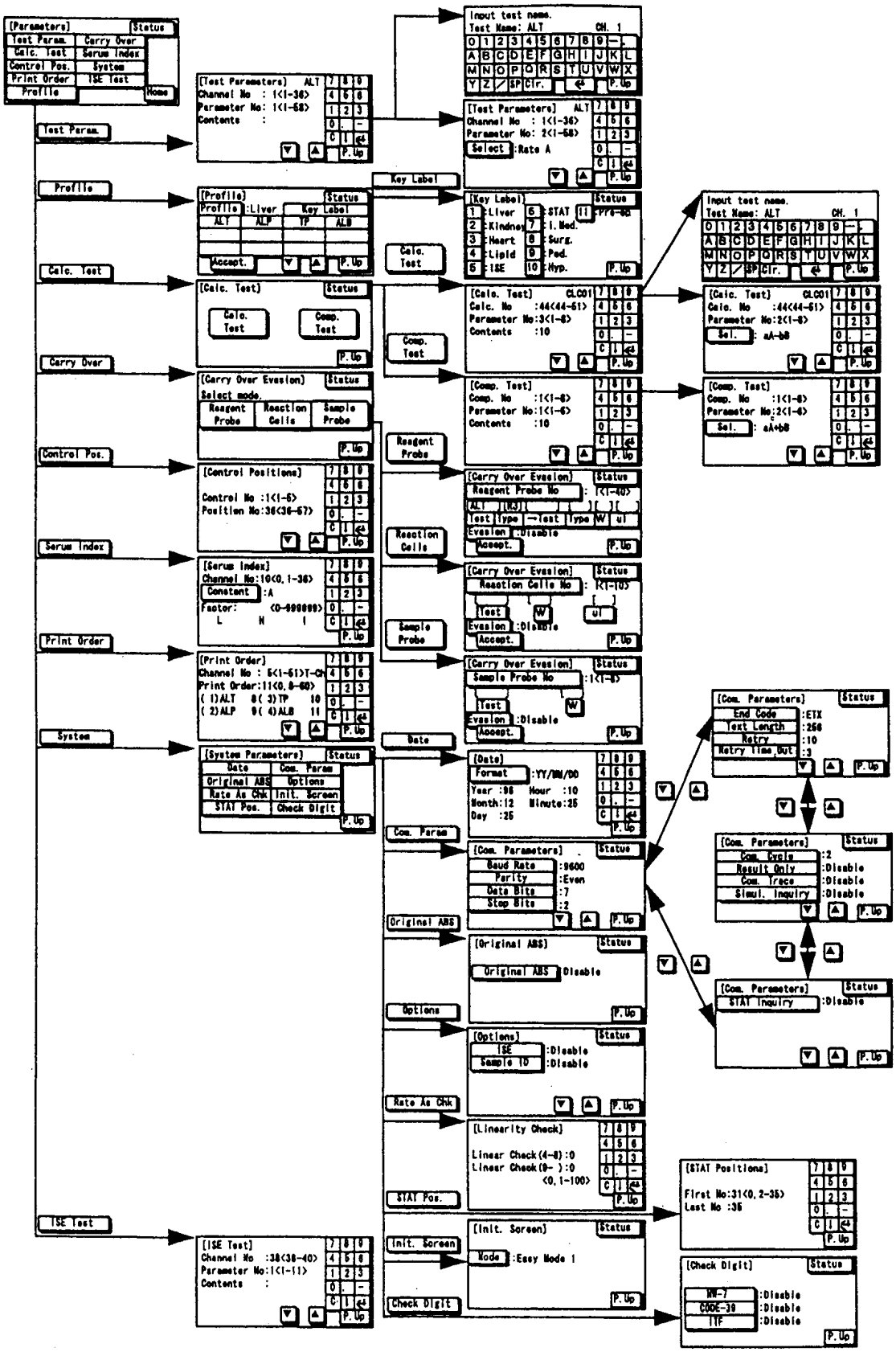
7.6.1 Screen Configuration of Model 7020 Automatic Analyzer

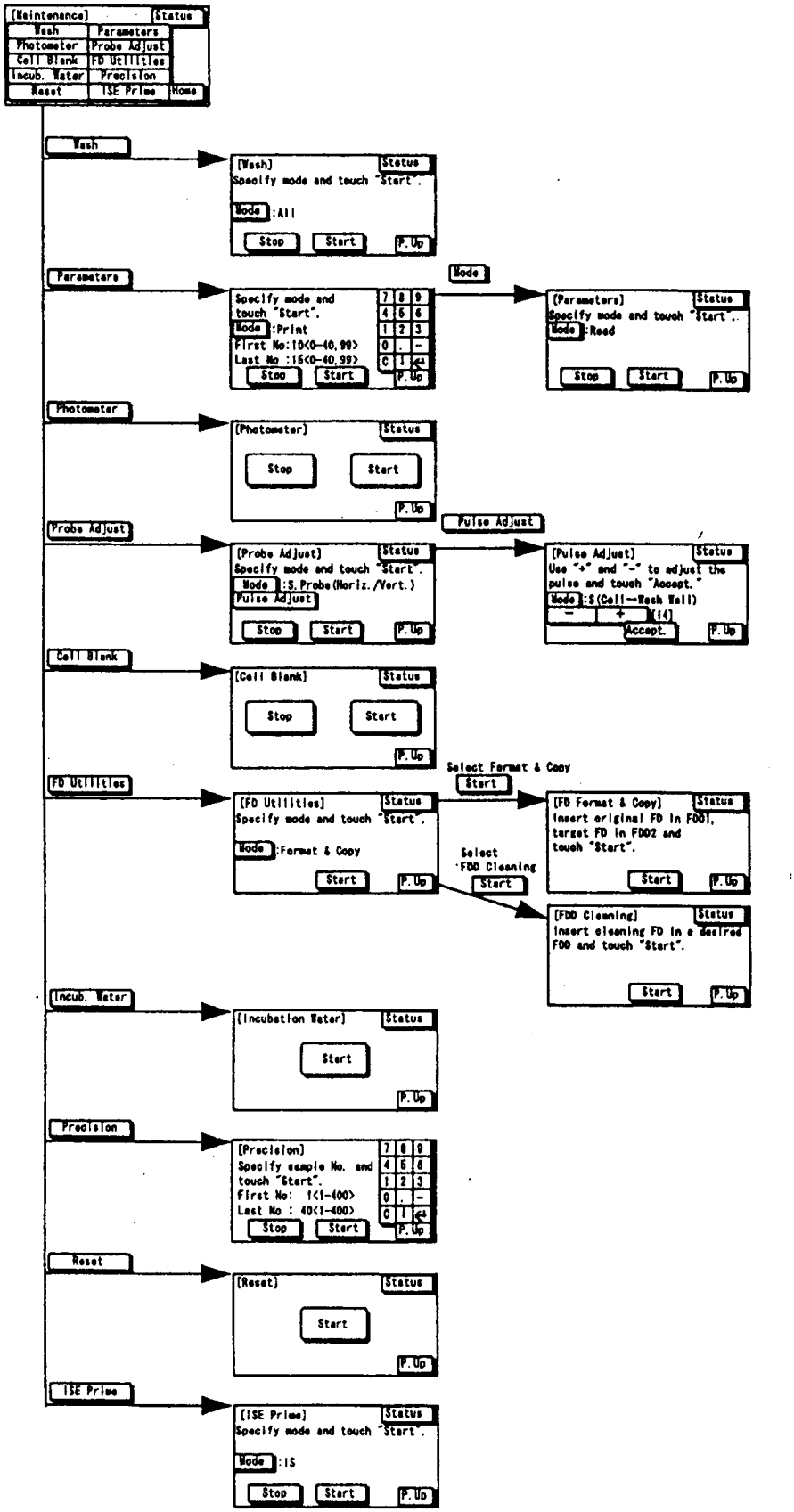


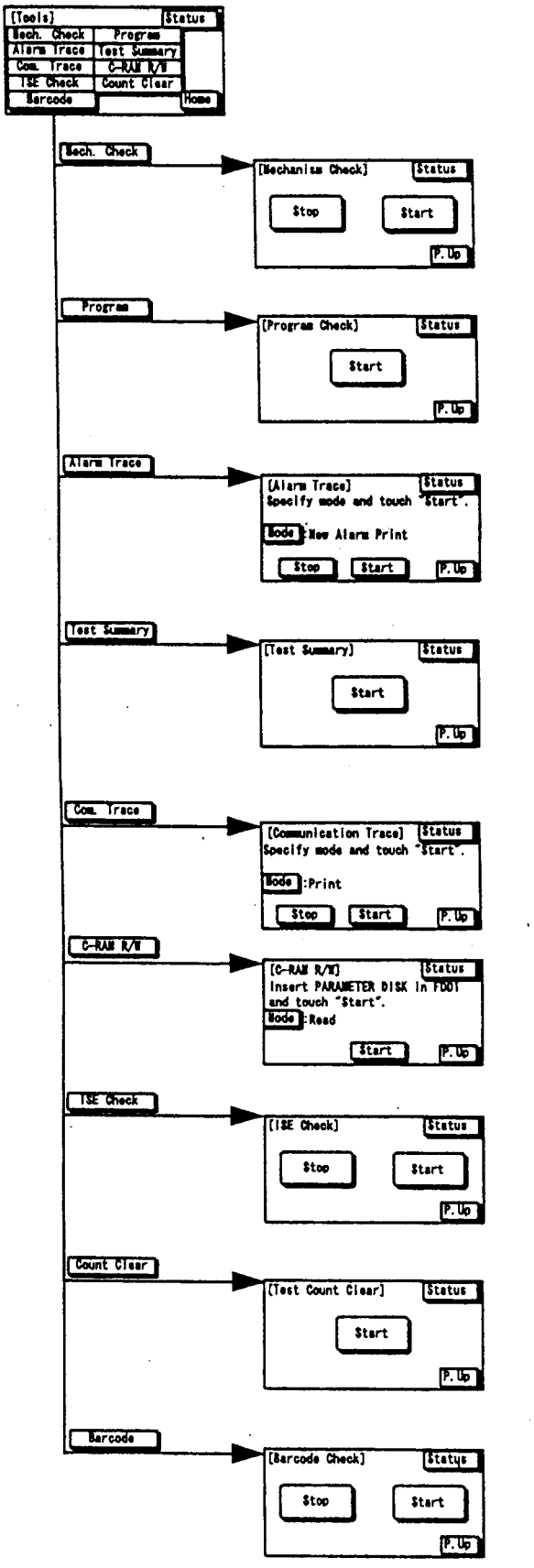
7.6.2 Screen Transition Diagram




[Monitor]
Status
Routine Samples
STAT Samples
Calibration
ISE Calibration
Control Samples
Home
Routine Samples
[Routine Samples]
Status
Display
Print
Send
Delete
FD(ASCII)
P.Up
Display
Print
Send
Delete
FD(ASCII)
[Routine Result, Disp.]
First No: 1<1-400>
[Routine Result, Print]
First No: 1<1-400>
Last No : 40<1-400>
Stop
Start
[Routine Result, Send]
First No: 1<1-400>
Last No : 40<1-400>
[Routine Result, Delete]
First No: 1<1-400>
Last No : 40<1-400>
[Routine Result, ASCII]
DATA DISK →FDD1
Target Disk →FDD2
First No: 1<1-400>
Last No : 40<1-400>
Start
[Routine Result, Delete]
Status
"Start":Delete the routine data.
Start
P.Up
STAT Samples
[STAT Samples]
Status
Display
Print
Send
Delete
FD(ASCII)
P.Up
Display
Print
Send
Delete
FD(ASCII)
[STAT Result, Disp.]
First No: 1<1-50>
[STAT Result, Print]
First No: 1<1-50>
Last No :40<1-50>
Stop
Start
[STAT Result, Send]
First No: 1<1-50>
Last No :40<1-50>
[STAT Result, Delete]
First No: 1<1-50>
Last No :40<1-50>
[STAT Result, ASCII]
DATA DISK →FDD1
Target Disk →FDD2
First No: 1<1-50>
Last No :40<1-50>
Start
[STAT Result, Delete]
Status
"Start":Delete the routine data.
Start
P.Up
Calibration
[Calibration]
Cannel No: 1<1-36> ALT
ISE Calibration
[ISE Calibration]
Status
Cannel No
P.Up
Control Samples
[Control Samples]
Status
Print
Send
Delete
P.Up
Print
Send
Delete
[Control Result, Print]
First No :101<101-530>
Last No :102<101-530>
Stop
Start
[Control Result, Send]
First No :101<101-530>
Last No :102<101-530>
[Control Result, Delete]
First No :1<1-5>
Last No :2<1-5>
Start
[Control Result, Delete]
Status
"Start":Delete the routine data.
Start
P.Up


[Parameters]
Status
Test Param.
Carry Over
Calc. Test
Serum Index
Control Pos.
System
Print Order
ISE Test
Profile
Home
Test Param.
Profile
Calc. Test
Carry Over
Control Pos.
Serum Index
Print Order
System
ISE Test
[Test Parameters] ALT
Channel No : 1<1-36>
Parameter No: 1<1-68>
Contents :
Input test name.
Test Name: ALT
CH. 1
[Test Parameters] ALT
Channel No : 1<1-36>
Parameter No: 2<1-68>
Select :Rate A
[Profile]
Status
Profile :Liver
Key Label
ALT
ALP
TP
ALB
Accept.
Key Label
[Key Label]
Status
1 :Liver
2 :Kindney
3 :Heart
4 :Lipid
5 :ISE
6 :STAT
7 :I. Med.
8 :Surg.
9 :Ped.
10 :Hyp.
11 :PPI-88
[Calc. Test]
Status
Calc. Test
Comp. Test
Calc. Test
[Calc. Test] CLC01
Calc. No :44<44-61>
Parameter No:3<1-8>
Contents :10
Comp. Test
[Comp. Test]
Comp. No :1<1-8>
Parameter No:1<1-6>
Contents :10
[Carry Over Evasion]
Status
Select mode.
Reagent Probe
Reaction Cells
Sample Probe
Reagent Probe
[Carry Over Evasion]
Reagent Probe No : 1<1-40>
ALT
Test Type →Test Type W ul
Evasion :Disable
Accept.
Reaction Cells
[Carry Over Evasion]
Reaction Cells No : 1<1-10>
Test
W
ul
Evasion :Disable
Accept.
Sample Probe
[Carry Over Evasion]
Sample Probe No : 1<1-5>
Test
W
Evasion :Disable
Accept.
[Control Positions]
Control No :1<1-5>
Position No:36<36-57>
[Serum Index]
Channel No:10<0, 1-36>
Constant :A
Factor: <0-999999>
L H I
[Print Order]
Channel No : 5<1-61>[-Ch
Print Order:11<0, 8-60>
(1)ALT 8(3)TP 10
(2)ALP 9(4)ALB 11
[System Parameters]
Status
Date
Com. Param
Original ABS
Options
Rate As Chk
Init. Screen
STAT Pos.
Check Digit
Date
[Date]
Format :YY/MM/DD
Year :96 Hour :10
Month:12 Minute:25
Day :25
Com. Param
[Com. Parameters]
Baud Rate :9600
Parity :Even
Data Bits :7
Stop Bits :2
[Com. Parameters]
End Code :ETX
Text Length :256
Retry :10
Retry Time Out :3
[Com. Parameters]
Com. Cycle :2
Result Only :Disable
Com. Trace :Disable
Simul. Inquiry :Disable
[Com. Parameters]
STAT Inquiry :Disable
Original ABS
[Original ABS]
Original ABS :Disable
Options
[Options]
ISE :Disable
Sample ID :Disable
Rate As Chk
[Linearity Check]
Linear Check(4-8) :0
Linear Check(9-) :0
<0, 1-100>
STAT Pos.
[STAT Positions]
First No:31<0, 2-35>
Last No :35
Init. Screen
[Init. Screen]
Mode :Easy Mode 1
Check Digit
[Check Digit]
Status
NW-7 :Disable
CODE-39 :Disable
ITF :Disable
[ISE Test]
Channel No :38<38-40>
Parameter No:1<1-11>
Contents :


[Maintenance]
Status
Wash
Parameters
Photometer
Probe Adjust
Cell Blank
FD Utilities
Incub. Water
Precision
Reset
ISE Prime
Home
Wash
[Wash]
Specify mode and touch "Start".
Mode :All
Stop
Start
P.Up
Parameters
Specify mode and touch "Start".
Mode :Print
First No:1(0-40,99)
Last No :15(0-40,99)
Mode
[Parameters]
Specify mode and touch "Start".
Mode :Read
Photometer
[Photometer]
Probe Adjust
[Probe Adjust]
Specify mode and touch "Start".
Mode :S.Probe(Horiz./Vert.)
Pulse Adjust
Pulse Adjust
[Pulse Adjust]
Use "+" and "-" to adjust the pulse and touch "Accept."
Mode :S(Cell→Wash Well)
Accept.
Cell Blank
[Cell Blank]
FD Utilities
[FD Utilities]
Specify mode and touch "Start".
Mode :Format & Copy
Select Format & Copy
Start
[FD Format & Copy]
Insert original FD in FDD1, target FD in FDD2 and touch "Start".
Select FDD Cleaning
Start
[FDD Cleaning]
Insert cleaning FD in a desired FDD and touch "Start".
Incub. Water
[Incubation Water]
Precision
[Precision]
Specify sample No. and touch "Start".
First No: 1(1-400)
Last No : 40(1-400)
Reset
[Reset]
ISE Prime
[ISE Prime]
Specify mode and touch "Start".
Mode :IS


[Tools]
Status
Mech. Check
Program
Alarm Trace
Test Summary
Com. Trace
C-RAM R/W
ISE Check
Count Clear
Barcode
Home
Mech. Check
[Mechanism Check]
Status
Stop
Start
P.Up
Program
[Program Check]
Status
Start
P.Up
Alarm Trace
[Alarm Trace]
Status
Specify mode and touch "Start".
Mode :New Alarm Print
Stop
Start
P.Up
Test Summary
[Test Summary]
Status
Start
P.Up
Com. Trace
[Communication Trace]
Status
Specify mode and touch "Start".
Mode :Print
Stop
Start
P.Up
C-RAM R/W
[C-RAM R/W]
Status
Insert PARAMETER DISK in FDD1
and touch "Start".
Mode :Read
Start
P.Up
ISE Check
[ISE Check]
Status
Stop
Start
P.Up
Count Clear
[Test Count Clear]
Status
Start
P.Up
Barcode
[Barcode Check]
Status
Stop
Start
P.Up

8. MOTORS, DETECTORS AND FUSES

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8. MOTORS, DETECTORS AND FUSES

8.1 Motor List

No.	Mechanism Name	Motor Type	Part No.	Controller (EMOT200)	Output Buffer (DRV)
1	Reaction disk rotation	PH265M-31-A5	713-0266	GPCONT-6	
2	Sample disk rotation	KP56KM1-014	707-0226	GPCONT-1	
3	Reagent disk rotation	↑	707-0226	GPCONT-2	
4	Rinse up/down	C6360-9212	707-0937	GPCONT-2	
5	Sample arm rotation	PX245M-02A	707-0298	GPCONT-3	SLA7021M
6	Sample arm up/down	KP56KM1-014	707-0226	GPCONT-3	(constant-current drive)
7	Reagent arm rotation	PX245M-02A	707-0298	GPCONT-4	
8	Reagent arm up/down	KP56KM1-014	707-0226	GPCONT-4	
9	Stirrer arm rotation	PX243M-03A	707-0300	GPCONT-5	
10	Stirrer arm up/down	C6470-9212	707-0936	GPCONT-5	
11	ISE sipper arm up/down	PX244M-02A	713-0326	GPCONT-6	
12	Sample syringe	SM55-4802	713-0316	GPCONT-7	MP4501
13	Reagent syringe	↑	713-0316	GPCONT-7	(constant-voltage drive)
14	ISE syringe	↑	713-0316	GPCONT-8	
15	Stirring rod rotation	LN12-M421N1B	707-0285	GMCONT	HD75452P

8.2 Detector List

No.	Class	Application	Type	Detection	Part No.
1	PCP	Home position of reaction disk	P1144-03	Dark	713-4142
2	PCP	For reaction disk count	(37365204)	Bright	713-4143
3	PCP	For reaction disk ADC	(37365204)	Bright	713-4143
4	PCP	Home position of S disk	GP1A34	Dark	J339165
5	PCP	For outer track of S disk	↑	Bright	↑
6	PCP	For inner track of S disk	↑	Bright	↑
7	PCP	Home position of R disk	↑	Dark	↑
8	PCP	For R disk count	↑	Bright	↑
9	PCP	Home position of S probe rotation	P1144	Dark	707-0426
10	PCP	Upper dead point of S probe	GP1A34	Dark	J339165
11	Conduction	Liquid level sensor for S probe	—	—	707-5041
12	PCP	Abnormal descent of S probe	EE-SX405	Dark	↑
13	PCP	Home position of R probe rotation	P1144	Dark	707-0426
14	PCP	Upper dead point of R probe	GP1A34	Dark	J339165
15	Conduction	Liquid level sensor for R probe	—	—	707-5041
16	PCP	Abnormal descent of R probe	EE-SX405	Dark	↑
17	PCP	Upper dead point of rinse mechanism	GP1A34	Dark	J339165
18	PCP	Upper dead point of stirring mechanism	↑	Dark	↑
19	PCP	Home position of stirring mechanism rotation	↑	Bright	↑
20	PCP	Stop position of stirring mechanism rotation	↑	Bright	↑
21	PCP	Upper dead point of S syringe	GP1A04	Dark	713-0315
22	PCP	Upper dead point of R s yringe	GP1A04	Dark	713-0315
23	PCP	Upper dead point of ISE syringe	GP1A04	Dark	713-0315
24	PCP	Upper dead point of ISE arm	GP1A34	Dark	J339165
25	Float SW	Water level in water tank	—	—	713-0319
26	Vacuum SW	Negative pressure in vacuum chamber	—	—	713-0312
27	Conduction	Waste solution level in vacuum chamber	—	—	713-0318
28	Conduction	Water level in incubation bath	—	—	714-4043
29	Conduction	Waste solution full	—	—	714-0391
30	Pt feeler	For control of temperature in incubation bath	—	—	717-0242

8.3 Fuse List

Listed below are the fuses used in the instrument.
For replacement, insert a fuse having the specified rating.

(1) Fuses on ACDIST Board (rear right side)

Fuse No.	Fuse Type	Rating (A)	Connected Load
F1	P430H	3	Power source for power operation relay
F2	P475H	7.5	Cooling unit
F3	P450H	5	DC power unit (5 V, 24 V, 12 V)
F4	P450H	5	Heater, pump
F5	P430H	3	For BMC
F6	P413H	1.3	For BM

(2) Fuses on DRV Board (front right side)

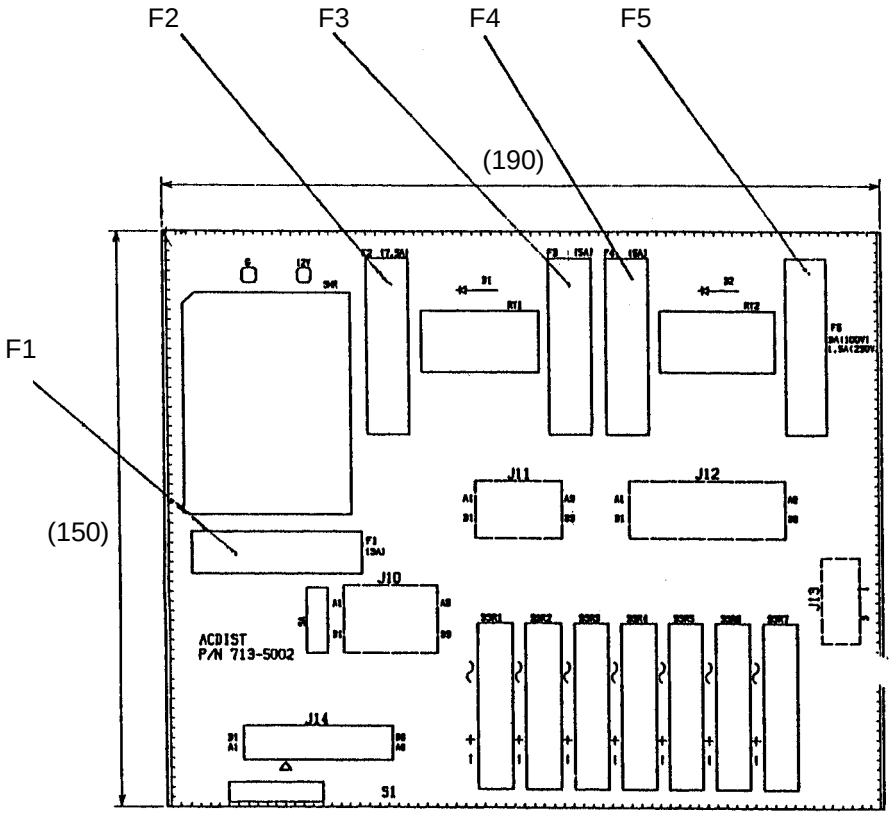
- 5 V Power Circuit

Fuse No.	Fuse Type	Rating (A)	Connected Load
F1	LM 50	5	ECPU237 board
F2	LM 50	5	EMIO100 board, LOG AMP board, ISE AMP board
F3	LM 50	5	DI board, DRV board, EMOT100 board, PCP in mechanism
F4	LM 50	5	FDD, printer, RSDIST board, LED board, ID reader

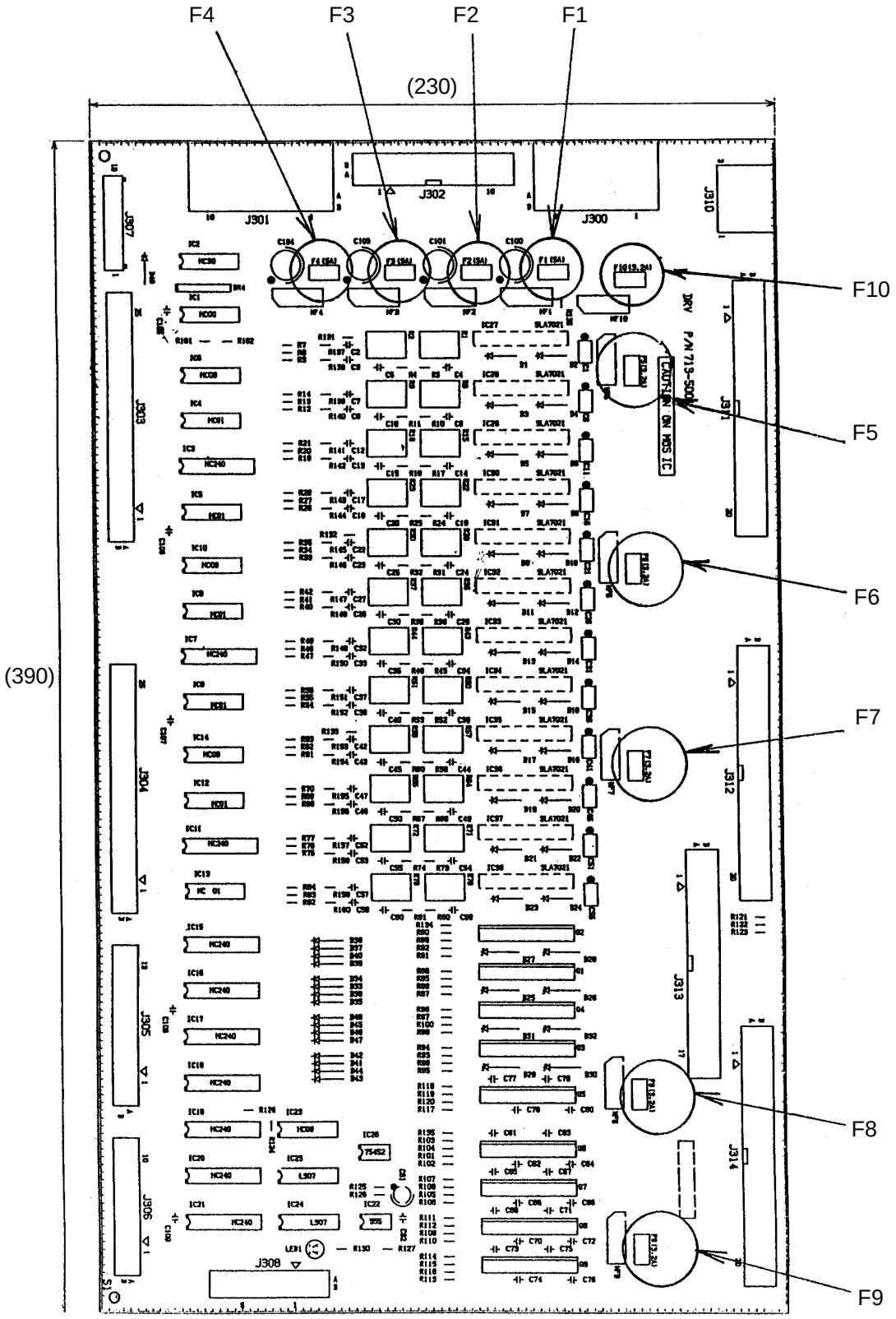
Fuse No.	Fuse Type	Rating (A)	Connected Load
F5	LM 32	3.2	Stepping motor for reaction/sample/reagent table rotation and rinse up/down
F6	LM 32	3.2	Stepping motor for sample arm and reagent arm up/down and rotation
F7	LM 32	3.2	Stepping motor for stirrer arm up/down and rotation and ISE sipper arm up/down
F8	LM 32	3.2	Stepping motor for sample/reagent/ISE syringe up/down, SV1 to 3, SV16
F9	LM 32	3.2	SV4 to 15, SV17 to 19
F10	LM 32	3.2	Display panel, printer, RSDIST board

8.3.1 Fuse Arrangement (AC/DC)

(1) AC Fuses (on ACDIST board)

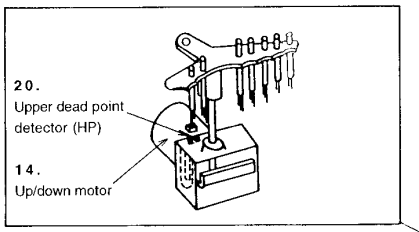


(2) DC Fuses (on DRV board)

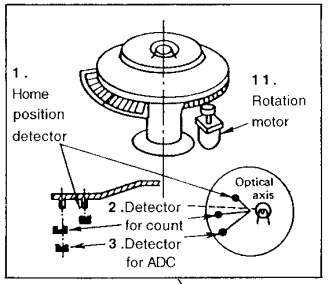


8.4 Motor and Detector Position

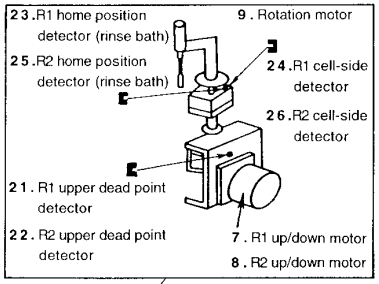
1. Rinse Mechanism



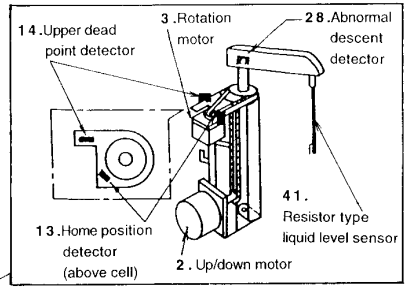
10. Reaction Disk Mechanism

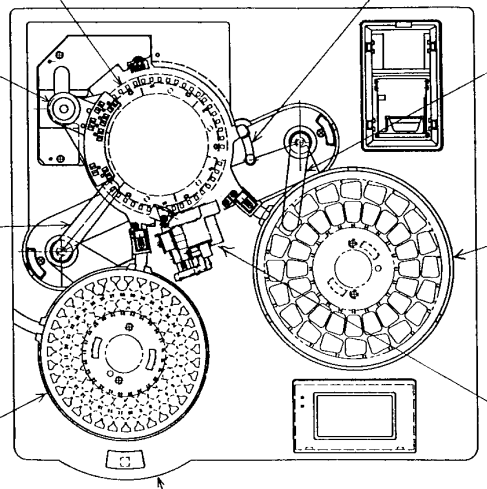


9. Stirring Mechanism (R1/4, R2/3)

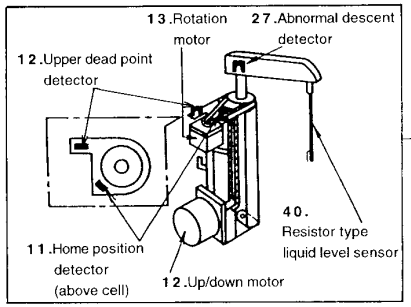


8. Reagent R1 (4) Sampling Mechanism

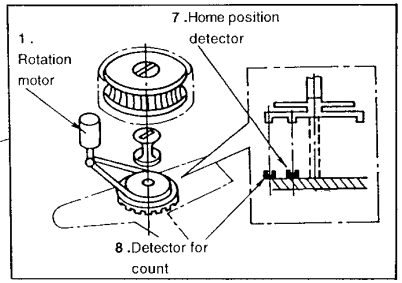




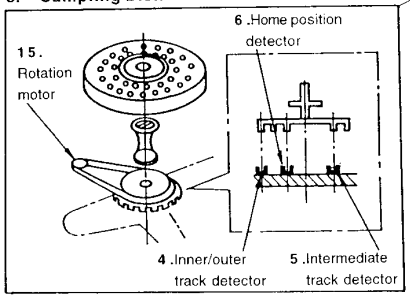
2. Serum Sampling Mechanism



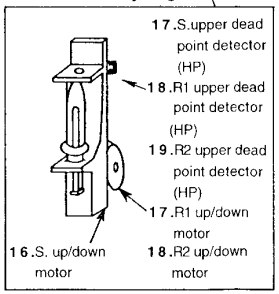
7. Reagent (R1/4) Disk Mechanism



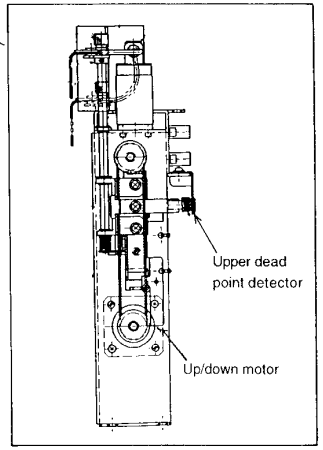
3. Sampling Disk Mechanism



5. Serum/R Syringe



11. ISE Mechanism



Motor and Detector Arrangement in Analytical Unit

8.5 Sensor Logic

Unit Name	Function	Sensor	Condition upon Detection	Output Signal	Inversion on DI Board
Sample arm up/down	Detection of liquid level	Resistor type	ON when liquid level is detected	H	Inverted
	Upper dead point	PC SHARP	Dark when at upper dead point	H	Inverted
	Abnormal descent	PC OMRON	Dark upon collision	H	Inverted
Sample arm rotation	HP, cell position	PC HAMA PHOTO	Dark when at HP	L	—
Reaction disk rotation	HP	PC HAMA PHOTO	Dark when at HP	L	—
	Cell count	PC HAMA PHOTO	Counting of dark → bright	H when counted	—
	ADC start	PC HAMA PHOTO	ADC start when dark → bright	H when started	Inverted
Sample disk rotation	HP	PC SHARP	Dark when at HP	H	Inverted
	Stop position on outer/ inner track	PC SHARP	Bright when at stop position	L	—
	Stop position on intermediate track	PC SHARP	Bright when at stop position	L	—
Reagent disk rotation	HP	PC SHARP	Dark when at HP	H	Inverted
	Stop position count	PC SHARP	Counting of dark → bright	L when counted	—
Syringe	Upper dead point	PC HAMA PHOTO	Dark when at upper dead point	L	—
Stirrer up/down	Upper dead point	PC SHARP	Dark when at upper dead point	H	Inverted
Stirrer arm rotation	HP	PC SHARP	Dark when at HP	L	—
	Stop position count	PC SHARP	Counting of dark → bright	L when counted	—
Rinse up/down	Upper dead point	PC SHARP	Dark when at upper dead point	H	Inverted
ISE sipper arm	Lower dead point	PC SHARP	Dark when at lower dead point	H	Inverted
Fuse	Detection of blowout	ON → OFF	ON when blown out	L	—
+5 V	Detection of abnormality in voltage	Comparator	L upon voltage drop	L	×
+12 V	Detection of abnormality in voltage	Comparator	L upon voltage drop	L	×
-15 V	Detection of abnormality in voltage	Comparator	H upon voltage drop	L	×
+15 V	Detection of abnormality in voltage	Comparator	L upon voltage drop	L	×
+24 V	Detection of abnormality in voltage	Comparator	L upon voltage drop	L	×
Float SW	Upper limit	Lead SW	OFF when full	H	Inverted
	Lower limit	Lead SW	ON when lowered	L	Inverted
Vacuum	Vacuum degree	ON - OFF	ON when deteriorated	L	—
Water level in vacuum chamber	Presence/absence of water	ON - OFF	ON when present	L	—

(cont'd)

Unit Name	Function	Sensor	Condition upon Detection	Output Signal	Inversion on DI Board
Water level in incubation bath	Presence/absence of water	ON - OFF	OFF when absent	H	Inverted
Waste solution level	Detection of filled condition	ON - OFF	ON when full	L	—
Operation SW	ON-OFF detection		ON when energized	L	Inverted

9. Analytical Methods

9.1 Analytical Method Table 9-1

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9.3.2 Cell Blank Compensation 9-11

9.4 Electrolyte Concentration Calculation 9-12

9. ANALYTICAL MEHOTDS

9.1 Analytical Method Table

Table 9-1 lists the analytical methods.

Table 9-1 Analytical Methods of Model 902

No.	Analytical Method		Photometric Point Setting Condition on Chemistry Parameters Screen	Minimum Necessary Total Liquid Volume (mL)	Cell Blank Value	Calculated Absorbance	Remarks
(1)	1-POINT		l -0 -0 -0 $1 \le l \le 35$	(S + V) ≥ 180	$\frac{C_1 + C_2 + C_3 + C_4}{4}$	$\frac{A_l + A_{l-1}}{2}$	
(2)	1-POINT (with prozone check)		l -m -0 -0 $1 \le l < m \le 35$	(S + V) ≥ 180	$\frac{C_1 + C_2 + C_3 + C_4}{4}$	$\frac{A_l + A_{l-1}}{2}$	$PC = \frac{A_m + A_{m-1}}{2} - k\frac{A_l + A_{l-1}}{2}$
(3)	2-POINT RATE		l -m -0 -0 $1 \le l < m \le 35$	(S + V) ≥ 180	$\frac{C_1 + C_2 + C_3 + C_4}{4}$	$\frac{\frac{A_m + A_{m-1}}{2} - \frac{A_l + A_{l-1}}{2}}{t}$	
(4)	2-POINT END (with prozone check)		l -m -n -p $1 \le l < n < p < m \le 35$ $p < m \le 35$	(S + V) ≥ 180	$\frac{C_1 + C_2 + C_3 + C_4}{4}$	$\frac{A_m + A_{m-1}}{2} - k\frac{A_l + A_{l-1}}{2}$	$PC = \left(\frac{\frac{A_{m'} + A_n}{m' - n}}{\frac{A_p - A_n}{p - n}} \right) \times 100$
(5)	3-POINT	First-half test A	l -0 -0 -0 $1 \le l \le m < n \le 35$	(S + V1) ≥ 180	$\frac{C_1 + C_2}{2}$	$\frac{A_l + A_{l-1}}{2}$	
		Second-half test B	m -n -0 -0 $1 \le l \le m < n \le 35$		$\frac{C_3 + C_4}{2}$	$\frac{A_n + A_{n-1}}{2} - k\frac{A_m + A_{m-1}}{2}$	
(6)	1-POINT RATE	First-half test A	l -0 -0 -0 $1 \le m < n < l < p < q \le 35$	(S + V1) ≥ 180	$\frac{C_1 + C_2}{2}$	$\frac{A_l + A_{l-1}}{2}$	
		Second-half test B	m -n -p -q $1 \le m < n < l < p < q \le 35$ $m + 2 < n,\ p + 2 < q$		$\frac{C_3 + C_4}{2}$	$\Delta A_{p \bullet q} - k\Delta A_{m \bullet n}$	
(7)	RATE-A		l - m - 0 - 0 $1 \le l < m \le 35;\ l + 2 < m$	(S + V1) ≥ 180	$\frac{C_1 + C_2 + C_3 + C_4}{4}$	$\Delta A_{l \bullet m}$	Sample blank compensable
(8)	RATE-A (with serum index measurement)		l - m - 0 - 0 $5 \le l < m \le 35;\ l + 2 < m$	(S + V1) ≥ 180	C_1 : For routine analysis C_2 : For 660/700 nm C_3 : For 570/600 nm C_4 : For 480/505 nm	$\Delta A_{l \bullet m}$	Sample blank compensable

No.	Analytical Method			Photometric Point Setting Condition on Chemistry Parameters Screen	Minimum Necessary Total Liquid Volume (μL)	Cell Blank Value	Calculated Absorbance	Remarks
(9)	RATE-B	(a) Mode 1	First-half test A	l -m -0 -0 $3 \leq l < m < n < p \leq 35$ $l + 2 < m$	$(S + V1) \geq 180$	$\frac{C_1 + C_2}{2}$	$\Delta A_{l \bullet m}$	
			Second-half test B	n -p -0 -0 $3 \leq l < m < n < p \leq 35$ $n + 2 < p$		$\frac{C_3 + C_4}{2}$	$\Delta A_{n \bullet p}$	When wavelength is different from that in first-half test
							$\Delta A_{n \bullet p} - k\Delta A_{l \bullet m}$	When wavelength is different from that in first-half test
		(b) Mode 2	First-half test A	l -m -0 -0 $3 \leq l < m < n < p < q < r \leq 35$ $l + 2 < m$	$(S + V1) \geq 180$	$\frac{C_1 + C_2}{2}$	$\Delta A_{l \bullet m}$	
			Second-half test B	n -p -q -r $3 \leq l < m < n < p < q < r \leq 35$ $n + 2 < p, p + 2 < q$		$\frac{C_3 + C_4}{2}$	$\Delta A_{q \bullet r} - k\Delta A_{n \bullet p}$	

(Legend)

l, m, n, p, q, r : Photometric points
S : Sample volume
V1, V2, V3 : Each set volume of reagents 1, 2 and 3
V : Total volume of reagents added
C_1 to C_4 : Passed cell blanks
A_x : Absorbance at photometric point x (*)
$\Delta A_{x \bullet y}$: Absorbance change rate per minute between photometric points x and y as obtained by least squares method
t : Time (minute) between photometric points l and m
k : Liquid volume compensation factor

$$k = \frac{S + V_a}{S + V_b}$$

V_a, V_b : Total volume of reagent added up to photometric point a or b

NOTE* : The absorbance value indicated or output by the instrument is the one obtained by multiplication with 10^4 and compensation with the cell blank value corresponding to each analytical method. For calculation, the indicated or output value should be multiplied by 10^{-4}.

Examples of Reaction Time Course

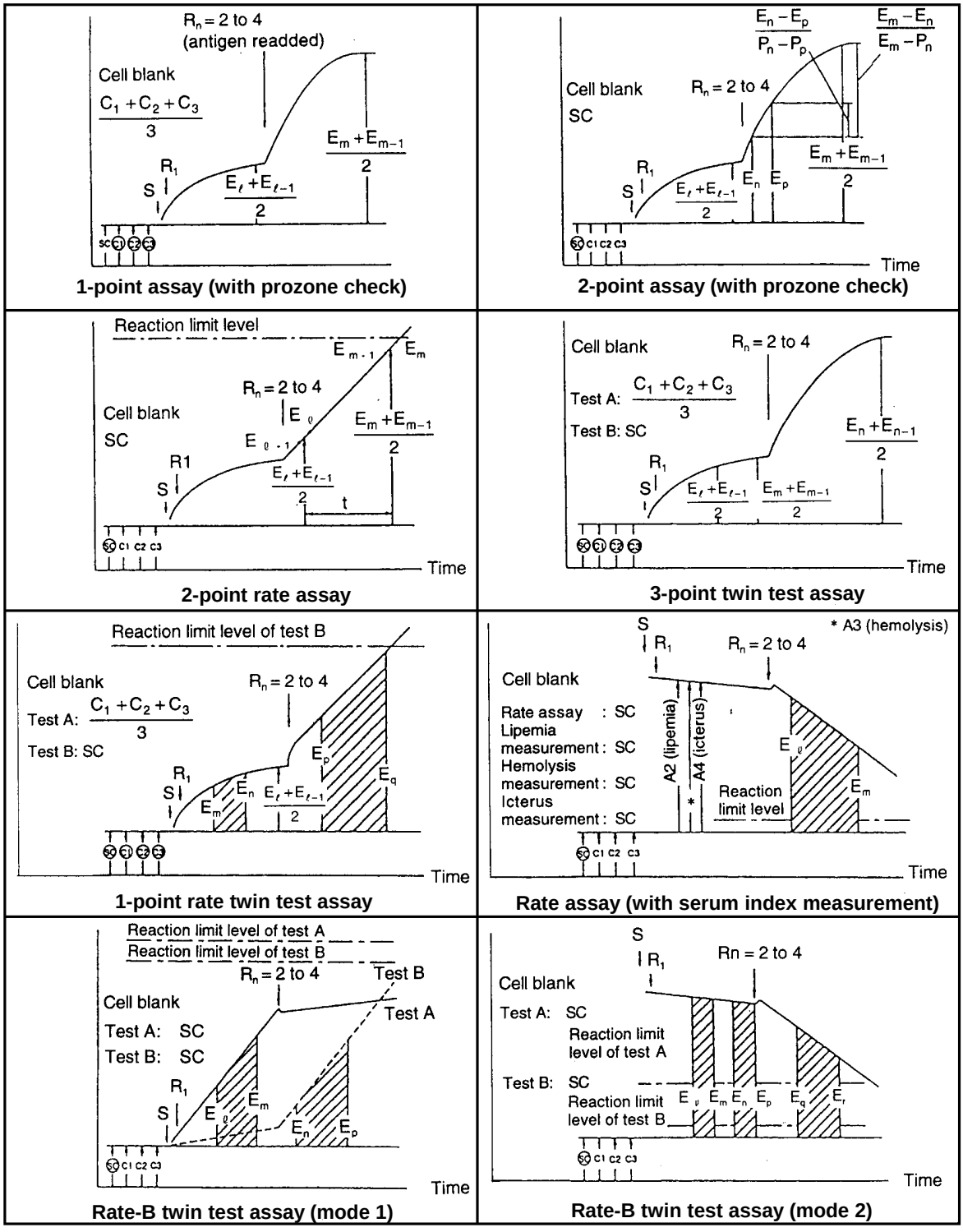
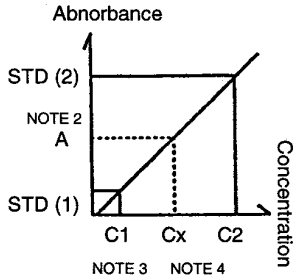
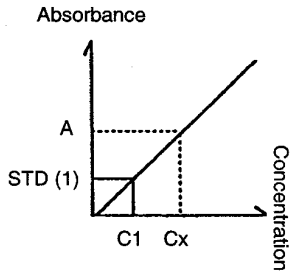


Fig. 9-1 Examples of Reaction Time Course

9.2 Types of Calibration

Table 9-2 lists the types of calibration.

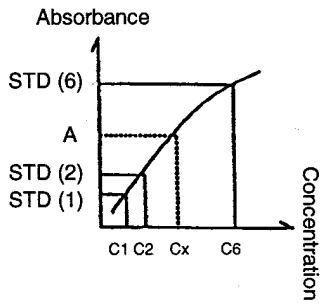
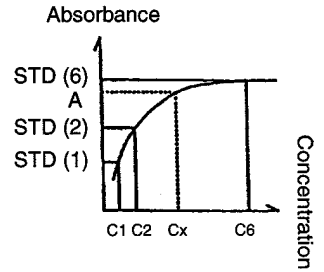
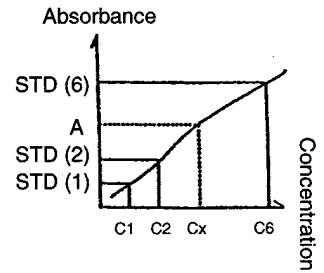
Table 9-2 Types of Calibration

Type	Calibration Curve	Standard Solution	Calibration Curve Parameter*	Concentration Calculation	Compatible Assay
Linear method - 2-point linear (LINEAR)		Standard solution (1) Standard solution (2)	S1 ABS K	Cx = {K·(X - STD (1) + C1)} × IFa + IFb [NOTE 5]	1-point assay 2-point rate assay 2-point end assay 3-point twin test assay 1-point rate twin test assay Rate-A assay Rate-B assay
K factor method - 1-point linear (LINEAR)		Standard solution (1)	S1 ABS K (input value)	Cx = {K·(X - STD (1) + C1)} × IFa + IFb	Same as in "Linear method — 2-point linear" above

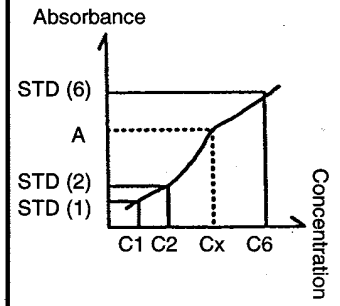
NOTES:

1. STD (1); Absorbance or absorbance change rate of standard solution (1)
   STD (2); Absorbance or absorbance change rate of standard solution (2)
   STD (3); Absorbance or absorbance change rate of standard solution (3)
   STD (4); Absorbance or absorbance change rate of standard solution (4)
   STD (5); Absorbance or absorbance change rate of standard solution (5)
   STD (6); Absorbance or absorbance change rate of standard solution (6)
2. A; Absorbance or absorbance change rate of sample
3. C1; Concentration of standard solution (1)
   C2; Concentration of standard solution (2)
   C3; Concentration of standard solution (3)
   C4; Concentration of standard solution (4)
   C5; Concentration of standard solution (5)
   C6; Concentration of standard solution (6)
4. Cx; Sample concentration
5. IFa, IFb; Instrument constants

(cont'd)

Type	Calibration Curve	Standard Solution	Calibration Curve Parameter*	Concentration Calculation	Compatible Assay
Non-linear method (LOGIT - LOG4P)		2 to 6 kinds of standard solutions are used.	S1 ABS K a b	$X = \frac{K}{1 + a \cdot (Cx - C1)^b} + S1ABS$	1-point assay 2-point rate assay 2-point end assay Rate-A assay
Non-linear method (LOGIT - LOG5P)		3 to 6 kinds of standard solutions are used.	S1 ABS K a b c	$A = 1 + \exp(-a + b \cdot \ln Cx' + c \cdot Cx') + S1ABS$ $Cx' = Cx - C1$	1-point assay 2-point rate assay 2-point end assay Rate-A assay
Non-linear method (SPLINE)		3 to 6 kinds of standard solutions are used.	a(l) b(l) c(l) d(l) Neither printed nor indicated	$A = a(l) + b(l) \cdot (Cx - STD(1)) + c(l) \cdot (Cx - STD(1))^2 + d(l) \cdot (Cx - STD(1))^3$	1-point assay 2-point rate assay 2-point end assay Rate-A assay

(cont'd)

Type	Calibration Curve	Standard Solution	Calibration Curve Parameter*	Concentration Calculation	Compatible Assay
Non-linear method (POLYGONAL)		3 to 6 kinds of standard solutions are used.	S1 ABS K1 K2 K3 K4 K5	Cx = Cn + Kn (A - STD (n))	1-point assay 2-point rate assay 2-point end assay Rate-A assay

9.2.1 Description of Model 902 Polygonal Line Calibration

[Formula of calibration curve]

$Cx = K(X - B) + C1$

(1) When CALIB. POINT = 1

(a) R. B. (Reagent Blank)
Updating of S1ABS: S1ABS = (X1(1) + X1(2))/2 (unit: 10^{-4} Abs)

(2) When CALIB. POINT = 3 to 6

(a) R. B. (Reagent Blank)
Same as in 1-point polygonal line calibration

(b) Full
Updating of S1ABS: Same as in R.B.

Updating of K factor (unit: 10^{-4} Abs)

$$K1 = \frac{C2 - C1}{X2 - X1} \times 10^{-4}$$

$$K2 = \frac{C3 - C2}{X3 - X2} \times 10^{-4}$$

$$K3 = \frac{C4 - C3}{X4 - X3} \times 10^{-4}$$

$$K4 = \frac{C5 - C4}{X5 - X4} \times 10^{-4}$$

$$K5 = \frac{C6 - C5}{X6 - X5} \times 10^{-4}$$

For output, K1 to K5 values in the above equations are multiplied by the correction factor which is obtained from the number of digits below the decimal point of STD (1) concentration (set on the chemistry parameter screen).

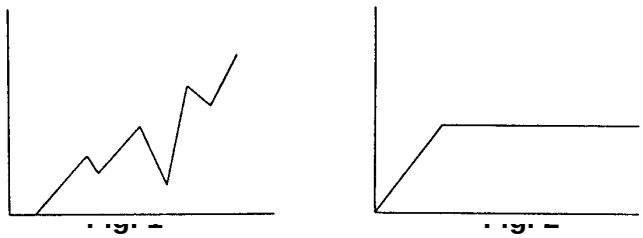
Number of Fractional Digits of STD (1)	Correction Factor
0	1
1	10^{-1}
2	10^{-2}
3	10^{-3}

For $\bar{X}1$, the previous $\bar{X}1$ value (S1ABS of CALIBRATION LIST) is used.

[Alarm check]

1. Checks of S1ABS, Dup, STD, SENS and CALIB. ??? are performed.

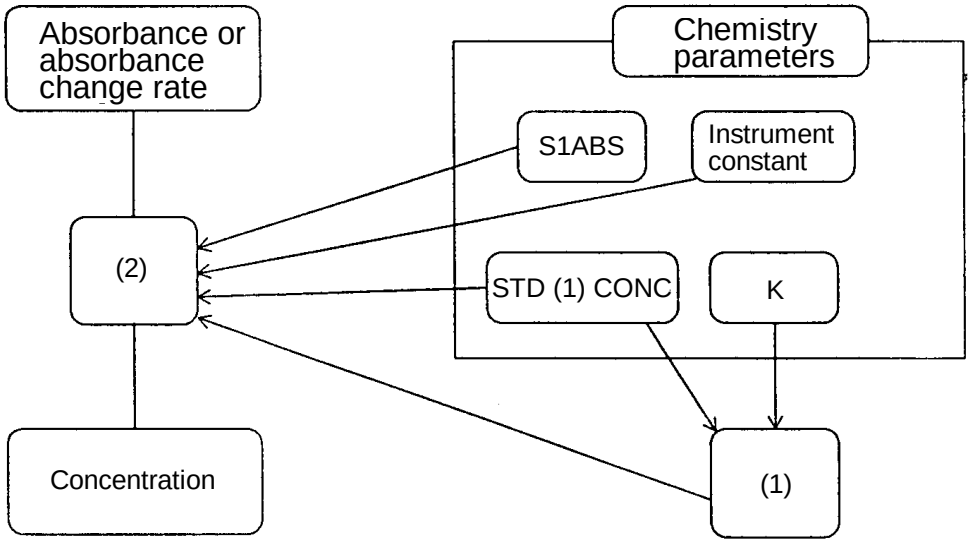
2. If the result of calibration is not monotone increasing or monotone decreasing (in the case shown in Fig. 1), the alarm "calculation disabled" is indicated.
   This alarm is also indicated if absorbance is the same between different standard numbers (see Fig. 2).



Concentration Calculation in Polygonal-Line Calibration

1. Concentration is calculated in the test whose CALIB. TYPE on the chemistry parameter screen is polygonal line.

2. Processing flow



(1) K

Among the data of calibration K1 to K5, the relevant K value is calculated.

9.3 Photometry Assay Concentration Calculation

This calculation is exemplified below on ALB.
Assume that standard solution 1 (reagent blank) and standard solution 2 have concentrations of 0.0 g/dL and 5.3 g/dL, respectively.

Calculation of S1ABS (absorbance of standard solution 1 $\times 10^4$)

$$S1ABS = \frac{448+445}{2} = 446.5 \xrightarrow{\text{Rounding off}} 447$$

"447" is indicated on the monitor menu 2 screen.

Calculation of K factor

$$K = \frac{C_2 - C_1}{A_2 - B}$$

C_2 : Concentration of standard solution 2
C_1 : Concentration of standard solution 1
A_2 : Printed absorbance of standard solution 2 $\times 10^{-4}$
B : Printed absorbance of standard solution 1 $\times 10^{-4}$

In the calculation of K value, each concentration value is rewritten into the integral part and exponential part, and calculation is carried out while ignoring the fractional digits (and the exponential part). The number of fractional digits is counted with reference to the concentration value of standard solution 1. Therefore, 0.0 is rewritten into 0×10^{-1}, and 5.3 into 53×10^{-1}, and values 0 and 53 are used for calculation.
The value 202 obtained by calculation is indicated on the monitor menu 2 screen.

$$K = \frac{53-0}{\left[\left(\frac{3050+3097}{2}\right)-\left(\frac{448+445}{2}\right)\right]\times 10^{-4}} = \frac{53}{(3074-447)\times 10^{-4}} = 202$$

Calculation of Sample Concentration

Given below is an example where the measured absorbance of a sample is 0.1637.

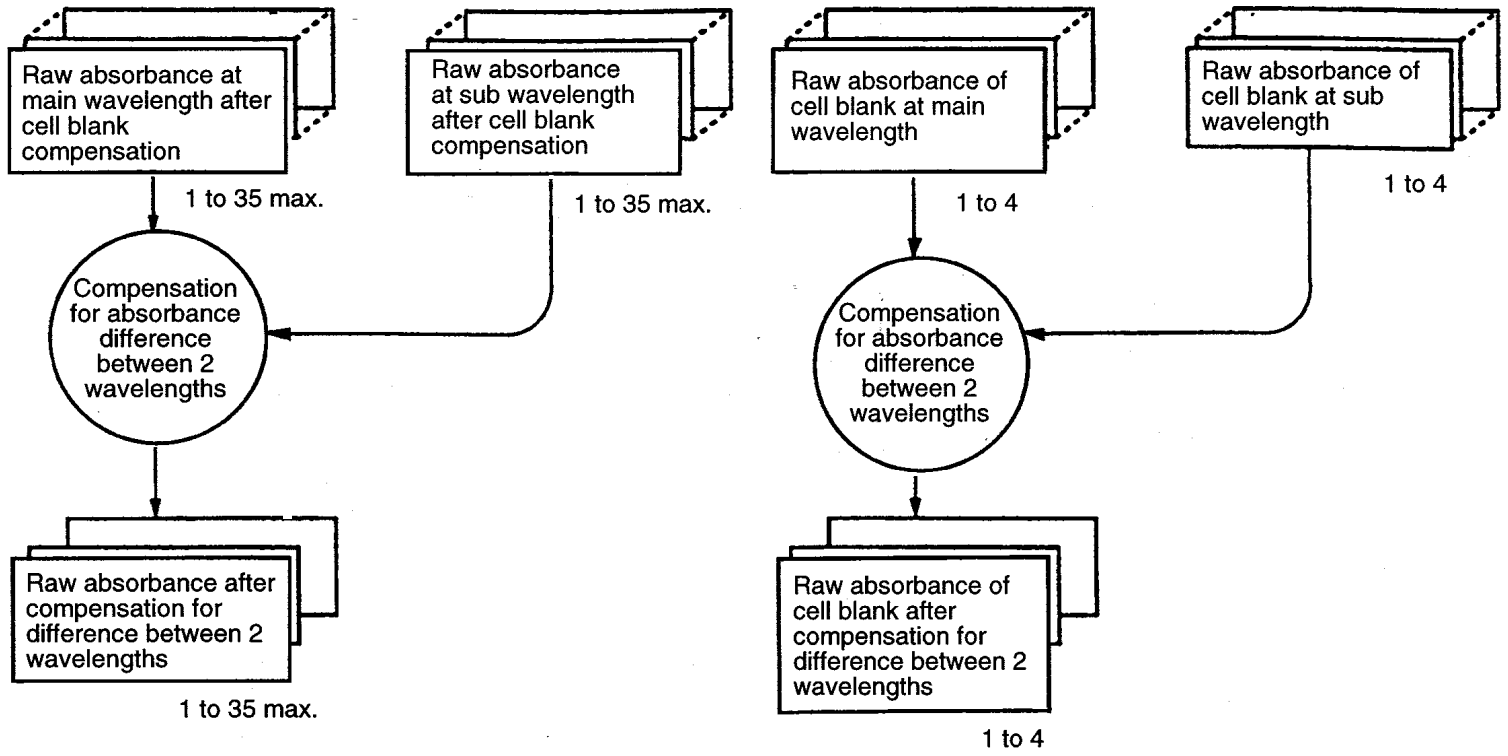
$Cx = \{K \bullet (Ax - B) + C_1\} \bullet 1F_A + IF_B$

- Cx : Concentration of sample
- K : Calibration factor
- Ax : Absorbance of sample
- C_1 : Concentration of standard solution 1
- B : Absorbance of standard solution 1 (S1ABS)
- IF_A : Instrument constant A (assumed to be 1.0)
- IF_B : Instrument constant B (assumed to be 0.0)

$Cx = [\ \{202 \bullet (0.1637 - 0.0447) + 0.0\ \} \bullet 1.0 + 0\ ] \times 10^{-1} = 2.39 \rightarrow 2.4$

In the above formula, the result of calculation is multiplied by the exponential part (10^{-1}), which was ignored in the calculation of K value and the product is rounded off to match scaling. Thus, the final Cx value is 2.4.

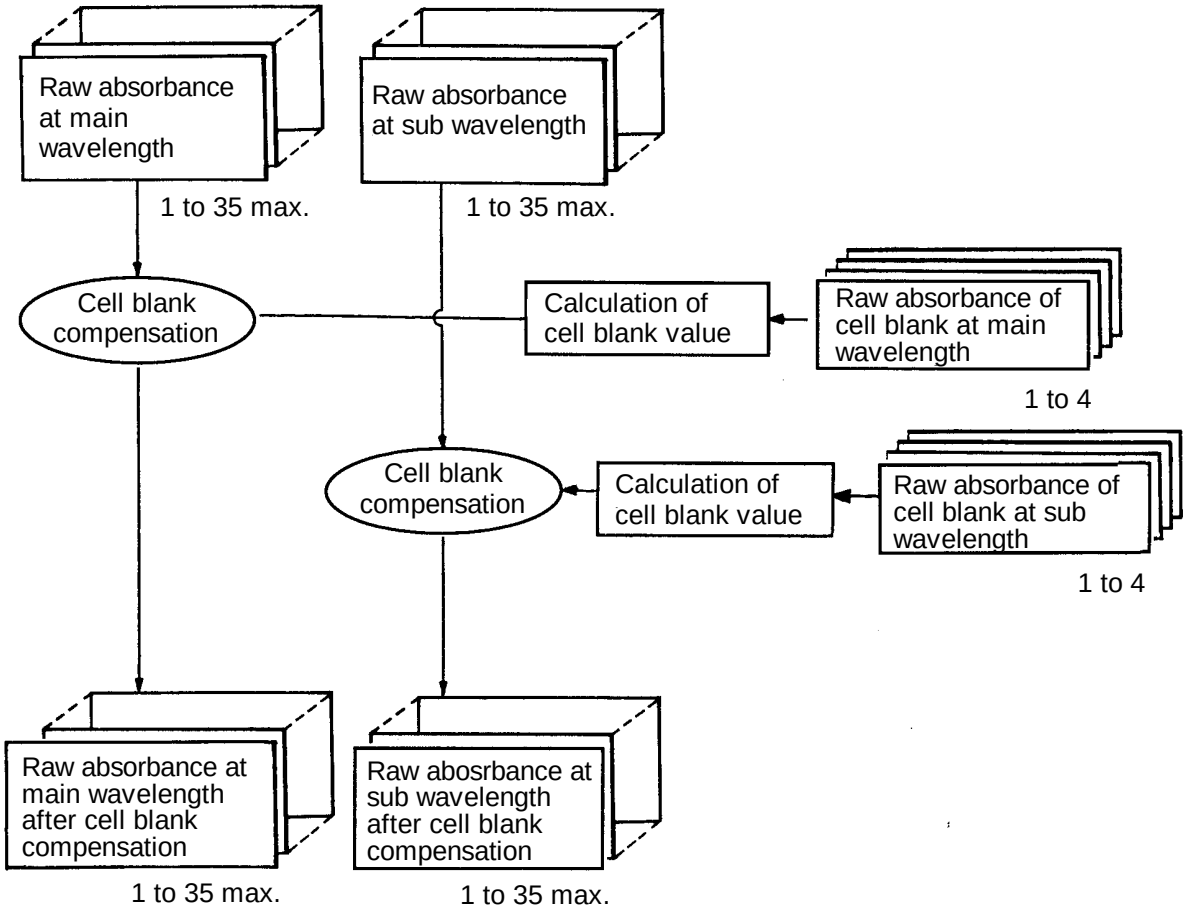
9.3.1 Dual-Wavelength Compensation


Raw absorbance at main wavelength after cell blank compensation
1 to 35 max.
Raw absorbance at sub wavelength after cell blank compensation
1 to 35 max.
Compensation for absorbance difference between 2 wavelengths
Raw absorbance after compensation for difference between 2 wavelengths
1 to 35 max.
Raw absorbance of cell blank at main wavelength
1 to 4
Raw absorbance of cell blank at sub wavelength
1 to 4
Compensation for absorbance difference between 2 wavelengths
Raw absorbance of cell blank after compensation for difference between 2 wavelengths
1 to 4

< Supplementary explanation >

1) On maximum photometric points 1 to 35 and cell blank (1 to 4), the sub-wavelength absorbance is subtracted from the main-wavelength absorbance.
2) Selection of cell blank (1 to 4) depends on analytical method. For details, refer to "9.1 Analytical Method Table."
3) Passed cell blank is used for operaiton.

9.3.2 Cell Blank Compensation


Raw absorbance at main wavelength
Raw absorbance at sub wavelength
1 to 35 max.
1 to 35 max.
Cell blank compensation
Calculation of cell blank value
Raw absorbance of cell blank at main wavelength
1 to 4
Cell blank compensation
Calculation of cell blank value
Raw absorbance of cell blank at sub wavelength
1 to 4
Raw absorbance at main wavelength after cell blank compensation
Raw abosrbance at sub wavelength after cell blank compensation
1 to 35 max.
1 to 35 max.

<Supplementary explanation>

The cell blank calculation method (Note) and compensated points vary with analytical method. For details, refer to the classification of analytical methods.

NOTE: If an alarm is indicated for any of cell blanks 1 to 4, the following table will be used.

Number of Alarms	Cell Blank Value	Data Alarm (cell blank abnormal)
1	Mean value of 2 data without alarm	Not indicated
2	$\frac{(C_1 + C_2 + C_3 + C_4)}{4}$	Indicated
3	$\frac{(C_1 + C_2 + C_3 + C_4)}{4}$	Indicated

9.4 Electrolyte Concentration Calculation

An example of Na calculation with use of the printout example on the previous page is described here.

Calculation of SL (slope value)

$$SL = \frac{E_H - E_L}{\log \frac{C_H}{C_L}}$$

$$= \frac{-32.0 - (39.6)}{\log \frac{160}{120}}$$

$$= 60.8$$

SL : Slope value
E_H : Electromotive force of HIGH solution (32.0)
E_L : Electromotive force of LOW solution (-39.6)
C_H : Concentration of HIGH solution (160.0)
C_L : Concentration of LOW solution (120.0)

Concentration calculation of internal standard solution

$$C_{IS} = CL \times 10^{\frac{E_{IS} - E_L}{SL}}$$

$$= 120.0 \times 10^{\frac{-35.4-(-39.6)}{60.8}}$$

$$= 140.7$$

C_{IS} : Concentration of internal standard solution
E_{IS} : Electromotive force of internal standard solution (-35.4)

Calculation of compensation value (C.VALUE)

The difference between the input value and measured value is obtained through measurement of the Hitachi calibrator having the known concentration.

$C.VALUE = C_c - C_x$
$= 139.0 - 138.9$
$= 0.1$

C_c : Input value (139.0)
C_x : Measured value (138.9)

Calculation of sample concentration

An example of calculation is presented here with the electric potential of sample at -35.5 mV.

$$C_s = C_{IS} \times 10^{\frac{E_S - E_{IS}}{SL}}$$

$$= 140.7 \times 10^{\frac{-35.5-(35.4)}{60.8}}$$

$$= 140.2$$

C_s : Concentration of sample
E_s : Electromotive force of sample

To the C_s value, the compensation value is added and the sum is printed.

C'_s = C_s + compensation value
= 140.2 + 0.1
= 140.3

C'_s: Sample concentration after compensation

10. CIRCUIT DIAGRAMS

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10.10 LOG AMP Board (707-5009) 10-50

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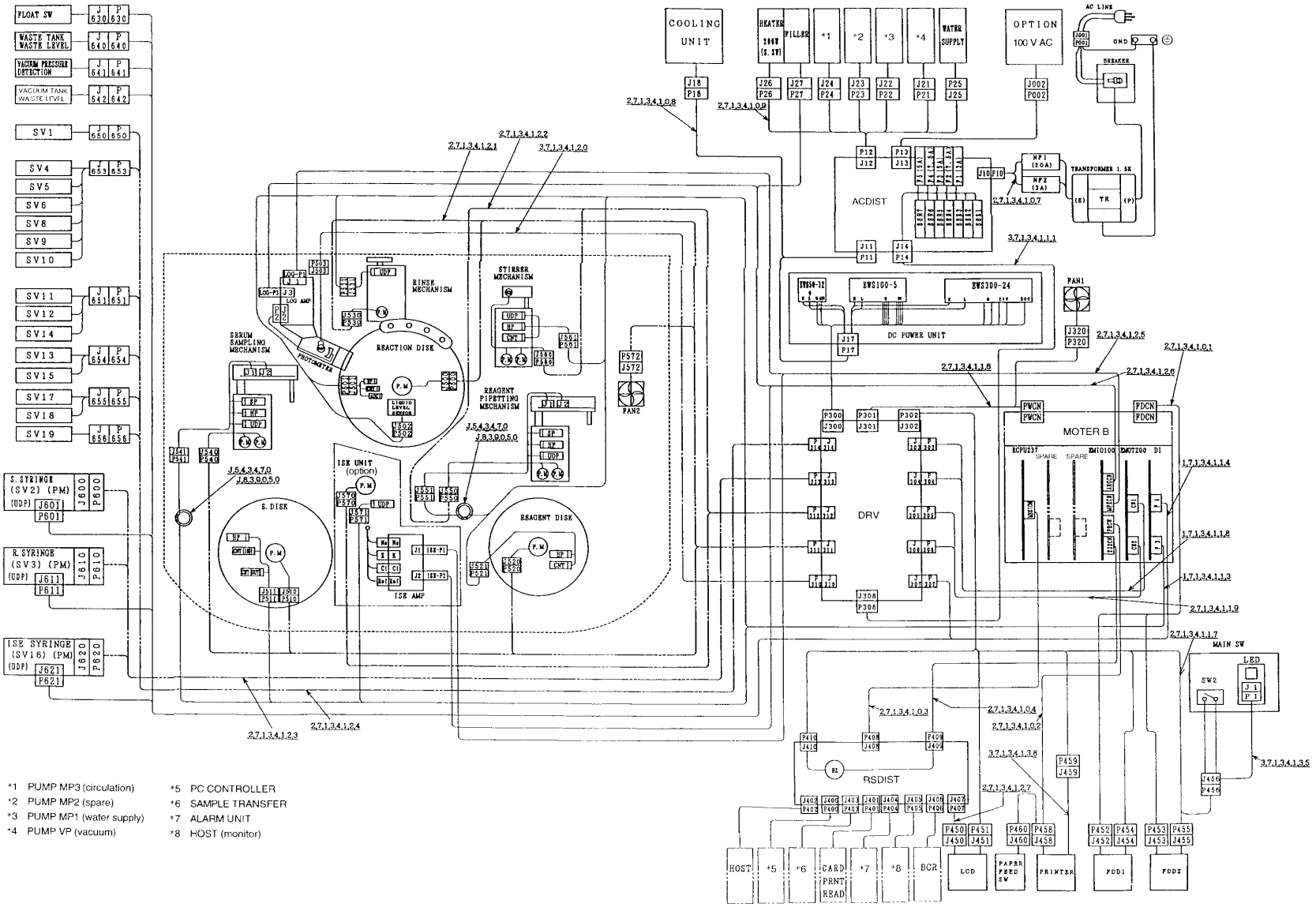
10.13 LED Board (713-5004) 10-56

10. CIRCUIT DIAGRAMS

10.1 Overall Wiring Diagram

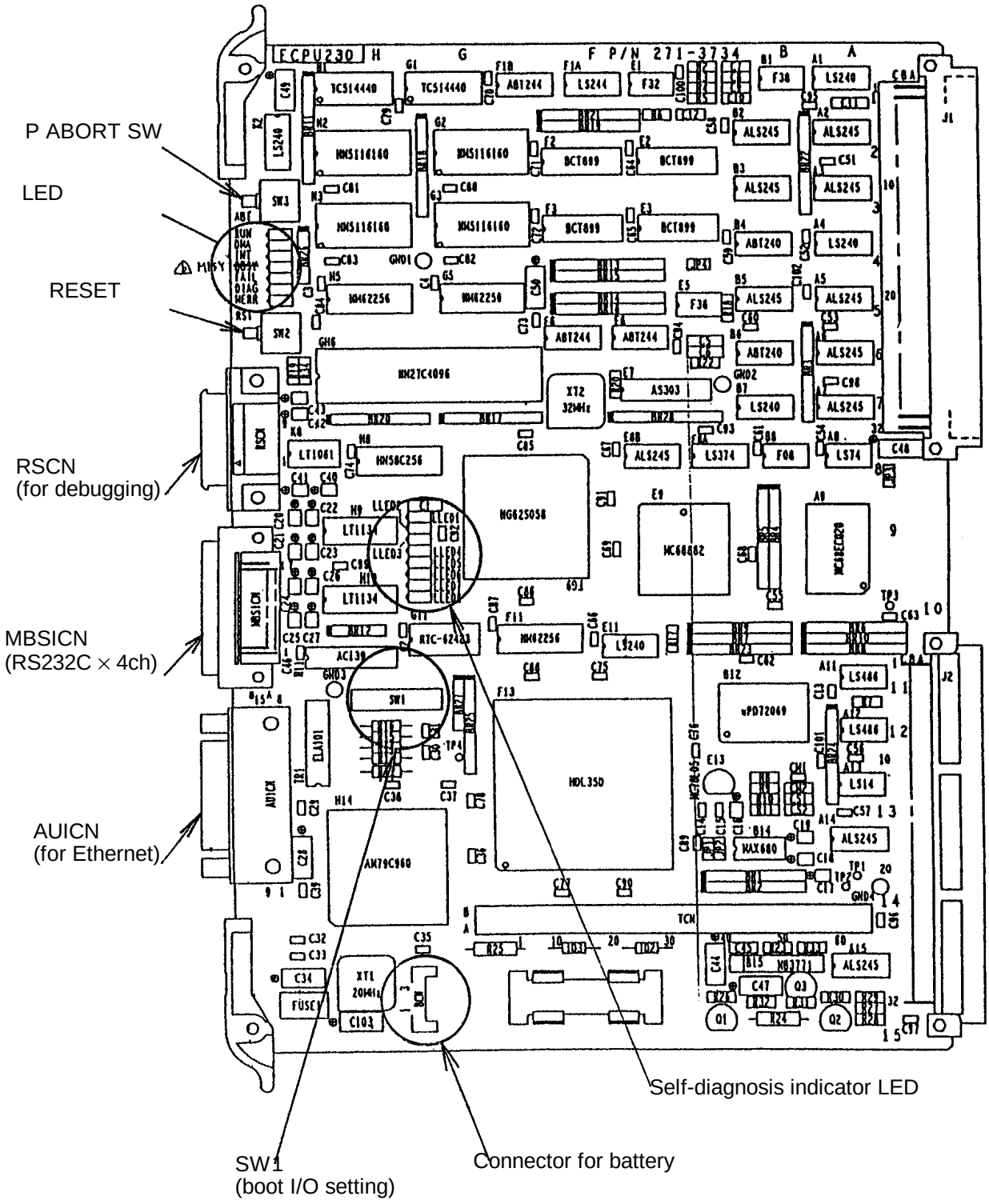


*1 PUMP MP3 (circulation)
*2 PUMP MP2 (spare)
*3 PUMP MP1 (water supply)
*4 PUMP VP (vacuum)
*5 PC CONTROLLER
*6 SAMPLE TRANSFER
*7 ALARM UNIT
*8 HOST (monitor)

10.2 ECPU237 Board

(1) Parts Mounting Diagram

Given below is the parts mounting diagram of the ECPU237 board.



(2) Explanation of Front Panel

LED

No.	Normal	Name	Color	Meaning
1	Lit	RUN	Green	CPU is running. (in any other state than HALT)
2	Dimly lit	DMA	Green	I/O assumes bus right according to DMA transfer procedure. (BBSY on VEM is in assert state.)
3		INT	Green	Request for interrupt is made to MPU.
4	Acces → Lit	MBSY	Green	Memory bus is busy. (Main memory is accessed.)
5	Lit	FAIL	Red	CPU double bus halt or WDT time up
6	Extinguished	DIAG	Red	Flickering : Self-diagnosis error Lit : Boot error, self-diagnosis under execution
7	Extinguished	MERR	Red	Parity error (SRAM or main memory on CPU board)

Miscellaneous

No.	Name	Meaning
1	RESET	Resetting of CPU board and system
2	ABORT	NMI to MPU
3	RSCN	Debugging monitor port
4	MBSICN	4-channel serial communication port
5	AUICN	Insert AUI connector

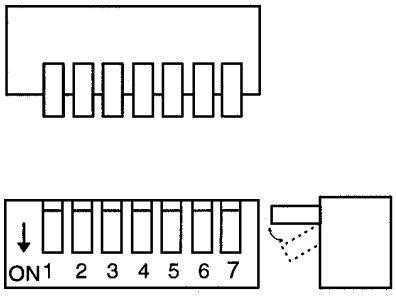
(3) Setting of DIP Switch

The DIP switch on the front panel is divided into operation mode setting part (SW1, 2, 3, 4) which determines operation at startup of the CPU board and program boot I/O setting part (SW5, 6, 7, 8). This switch setting is reflected on the system status register on the CPU board and can be read via software.

Explanation of SW1 Bits

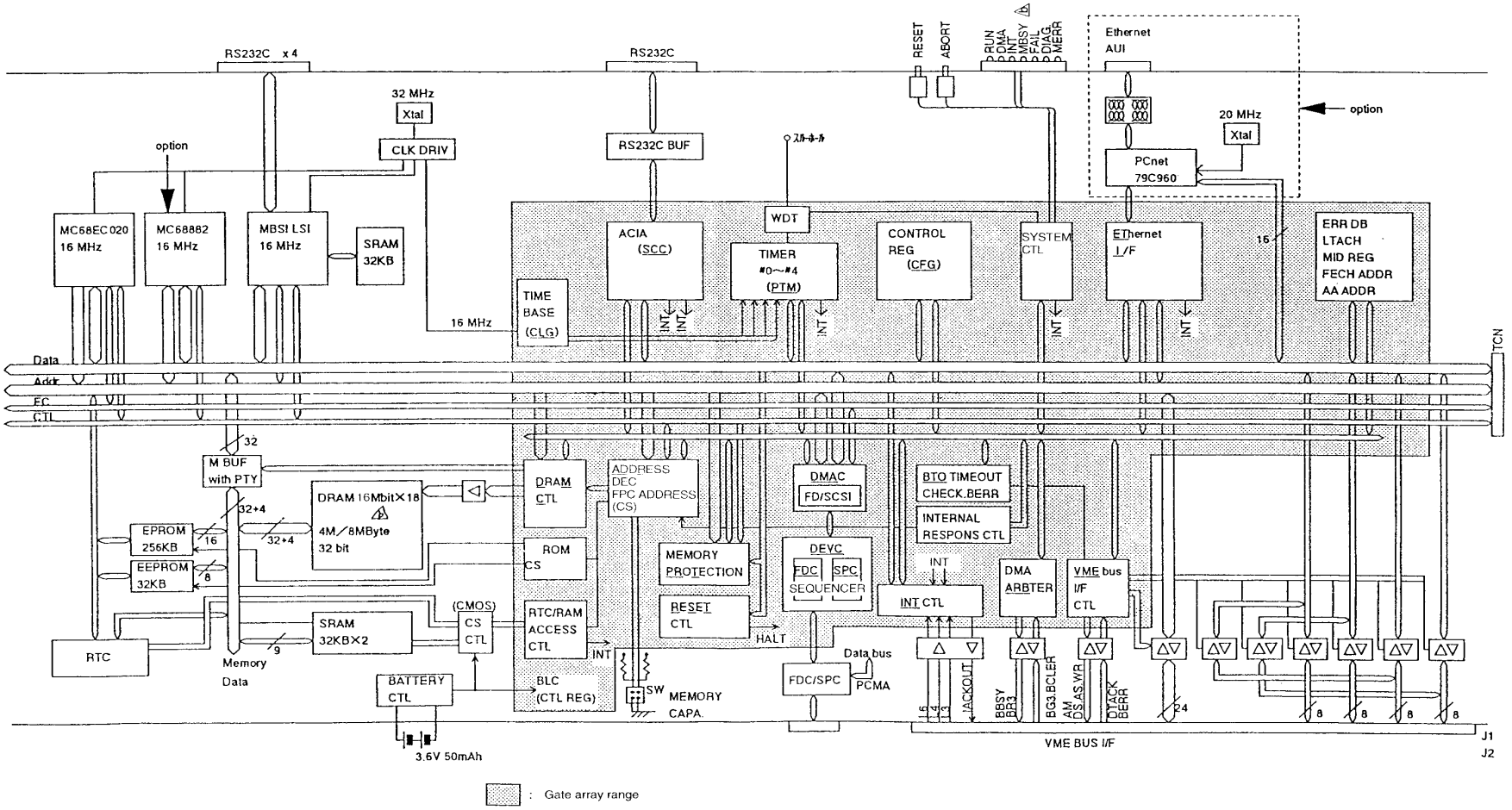
Switch No./Bit				Operation Mode
SW1 D7	SW2 D6	SW3 D5	SW4 D4	
0	0	0	0	Normal processing mode
0	0	0	1	Reserve
0	0	1	0	Reserve
0	0	1	1	Reserve
0	1	0	0	Continuous processing mode (memory BRAM)
0	1	0	1	Continuous processing mode (EEPROM)
0	1	1	0	Reserve
0	1	1	1	Reserve
1	0	0	0	Reserve
1	0	0	1	Reserve
1	0	1	0	Reserve
1	0	1	1	Reserve
1	1	0	0	T/M mode 1
1	1	0	1	T/M mode 2
1	1	1	0	T/M mode 3
1	1	1	1	T/M mode 4

External View of DIP Switch



Switch No./Bit				Boot I/O
SW5 D3	SW6 D2	SW7 D1	SW8 D0	
—	0	0	0	SCSI device (H/D, etc.)
—	0	0	1	F/D
—	0	1	0	Reserve
—	0	1	1	Reserve
—	1	0	0	Reserve
—	1	0	1	I/O file ROM
—	1	1	0	EEPROM
—	1	1	1	Ethernet
0	—	—	—	Memory dump with boot I/O
1	—	—	—	Memory dump with any other than boot I/O

Block Diagram of ECPU237 Board



RS-232C (1 channel) Connector Signal Table

RSCN (8850-20)		
No.	**A**	**B**
1		
2	TXD	
3	RTS	
4	RXD	
5	CTS	
6		
7	GND	
8		
9		
10		DTR-N

Ethernet (AUI) Connector Signal Table

AUICN			
No.	**Signal Name**	**No.**	**Signal Name**
1	GND	9	CI -
2	CI +	10	DO -
3	DO +	11	GND
4	GND	12	DI -
5	DI +	13	+ 12 V
6	GND	14	GND
7	GND	15	GND
8	GND		

RS-232C (4 channels) Connector Signal Table

MBCN (8850-34)		
No.	**A**	**B**
1	TXD 1	GND
2	RXD 1	
3	RTS 1	
4	CTS 1	
5	TXD2	GND
6	RXD 2	
7	RTS 2	
8	CTS 2	
9	TXD 3	GND
10	RXD 3	
11	RTS 3	
12	CTS 3	
13	TXD 4	GND
14	RXD 4	
15	RTS 4	
16	CTS 4	
17		

Connector Table

VME Bus Connector Signal Table (J1)

J1/P1 (VME BUS)			
No.	**A**	**B**	**C**
1	VD0 - P	BBSY - N	VD8 - P
2	VD1 - P	BCLR - N	VD9 - P
3	VD2 - P	VACFAIL - N	VD10 - P
4	VD3 - P	(BG0 IN - N)	VD11 -P
5	VD4 - P	(BG0 OUT - N)	VD12 - P
6	VD5 - P	(BG1 IN - N)	VD13 - P
7	VD6 - P	(BG1 OUT - N)	VD14 - P
8	VD7 - P	(BG2 IN - N)	VD15 - P
9	GND	(BG2 OUT - N)	GND
10	SYSCLK	(BG3 IN - N)	VSYSFAIL - N
11	GND	BGOUT 3 - N	BERRON
12	DS1 - N	(BREQ0 - N)	SYSRESET - N
13	DS0 - N	(BREQ1 - N)	LWORD - N
14	WRITE - N	(BREQ2 - N)	AM5 - P
15	GND	BREQ3 - N	VA23 - P
16	DTACK - N	AM0 - P	VA22 - P
17	GND	AM1 - P	VA21 - P
18	AS - N	AM2 - P	VA20 - P
19	GND	AM3 - P	VA19 - P
20	IACK - N	GND	VA18 - P
21	IACKIN - N	(SERCLK (1))	VA17 - P
22	IACKOUT - N	(SERDAT (1))	VA16 - P
23	AM4 - P	GND	VA15 - P
24	VA7 - P	(IRQ7 *)	VA14 - P
25	VA6 - P	IRQ6 *	VA13 - P
26	VA5 - P	(IRQ5 *)	VA12 - P
27	VA4 - P	IRQ4 *	VA11 - P
28	VA3 - P	IRQ3 *	VA10 - P
29	VA2-P	(IRQ2 *)	VA9 -P
30	VA1-P	(IRQ1 *)	VA8 - P
31	-12 V	+5 V STDBY	+12 V
32	+5 V	+5 V	+5 V

( ) : VME standard, not used on this board, NC
* : Negative polarity

VME Bus Connector Signal Table (J2)

J2/P2 (VME BUS & F/D)			
No.	**A**	**B**	**C**
1	MODESELECT - N	+5 V	HOLD - N
2	DS3 - N	GND	INDEX - N
3	DS0 - N	RESERVED	DS1 - N
4	DS2 - N	(VA 24)	EM0 -N
5	DIR - N	(VA 25)	STEP - N
6	GND	(VA 26)	GND
7	WRITEDATA - N	(VA 27)	WE - N
8	GND	(VA 28)	GND
9	TRK0 - N	(VA 29)	WPRT - N
10	READDATA - N	(VA 30)	SIDE - N
11	GND	(VA 31)	GND
12	READY - N	GND	
13	GND	+5 V	GND
14		VD16 - P	
15		VD17 - P	
16		VD18 - P	
17		VD19 - P	
18		VD20 - P	
19		VD21 - P	
20	GND	VD22 - P	
21		VD23 - P	
22		GND	
23		VD24 - P	
24		VD25 - P	GND
25	GND	VD26 - P	GND
26		VD27 - P	
27		VD28 - P	
28		VD29 - P	
29	+5 V	VD30 - P	+5 V
30	+5 V	VD31 - P	+5 V
31	GND	GND	GND
32	GND	+5 V	GND

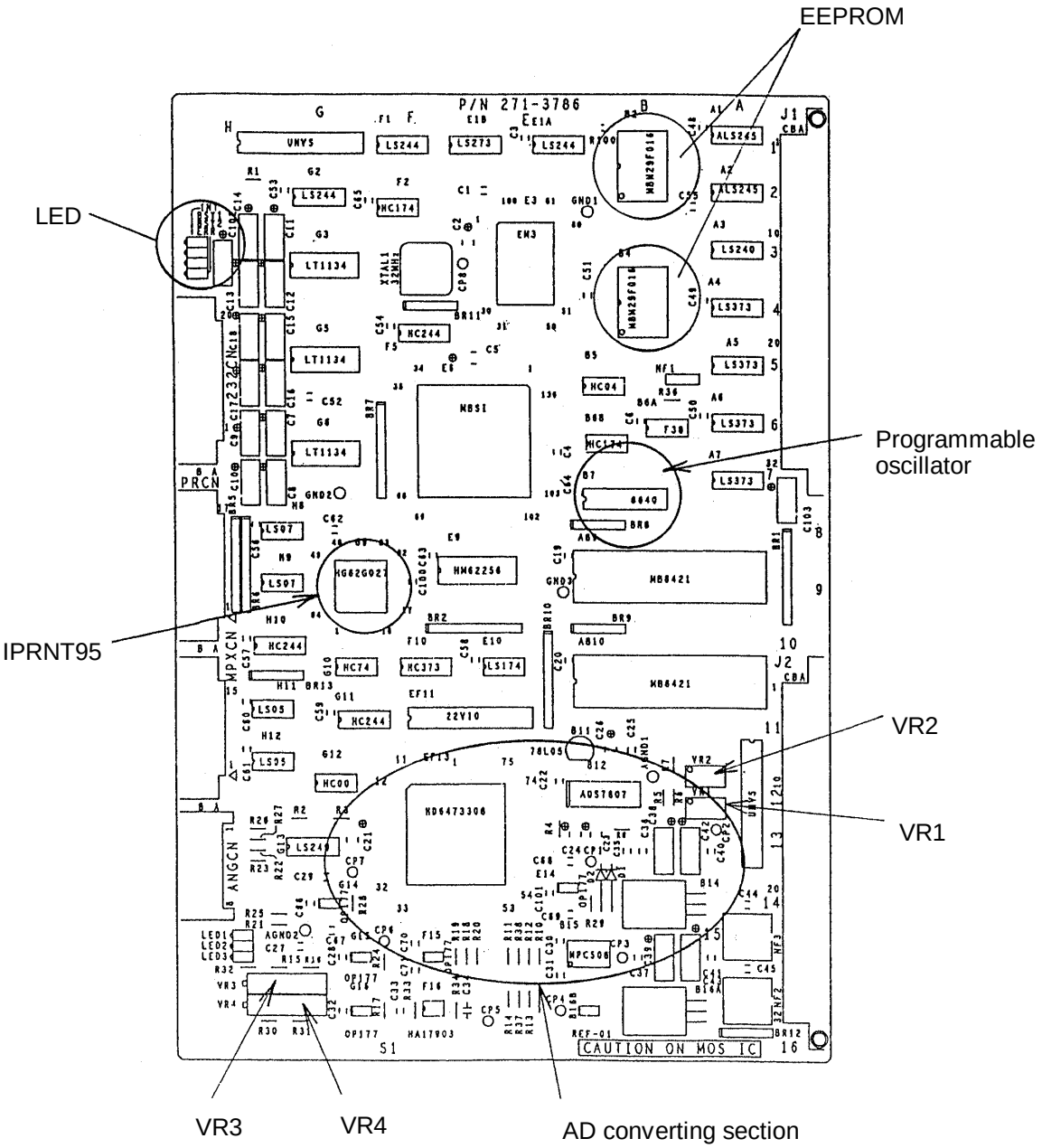
10.3 EMIO100 Board

(1) Explanation of Circuit Board

This circuit board is connected to the VME bus and has the following functions.

- EEPROM (4 Mbytes)
- 16-bit ADC (4 channels for photometry (main/sub), ISE, temperature)
- Temperature control
- Serial communication (RS-232C × 4 channels)
- Printer control (IPRNT95)
- Buzzer control (programmable oscillator)

(2) External View



(3) LED and VR

LED

No.	Name	Function
1	INT	Lit upon interrupt request from EMIO100 board.
2	BSY1	Extinguished during operation of ADC (channel 1, 3, 4).
3	BSY2	Extinguished during operation of ADC (channel 2).
4	ERR	Extinguished when HB command is abnormal.
5	LED1	Not mounted.
6	LED2	Not mounted.
7	LED3	Not mounted.

VR

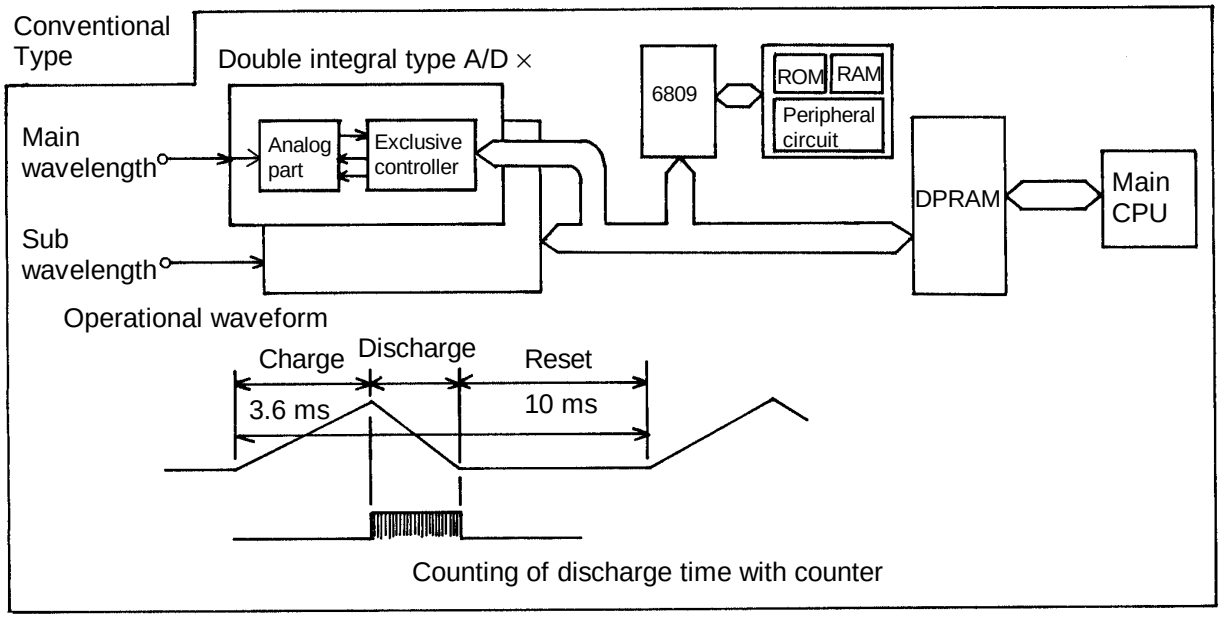
No.	Name	Function
1	VR1	For ADC (ADS7807) span correction*
2	VR2	For ADC (ADS7807) offset correction*
3	VR3	For adjustment of indicated temperature value
4	VR4	For adjustment of actual temperature in incubation bath

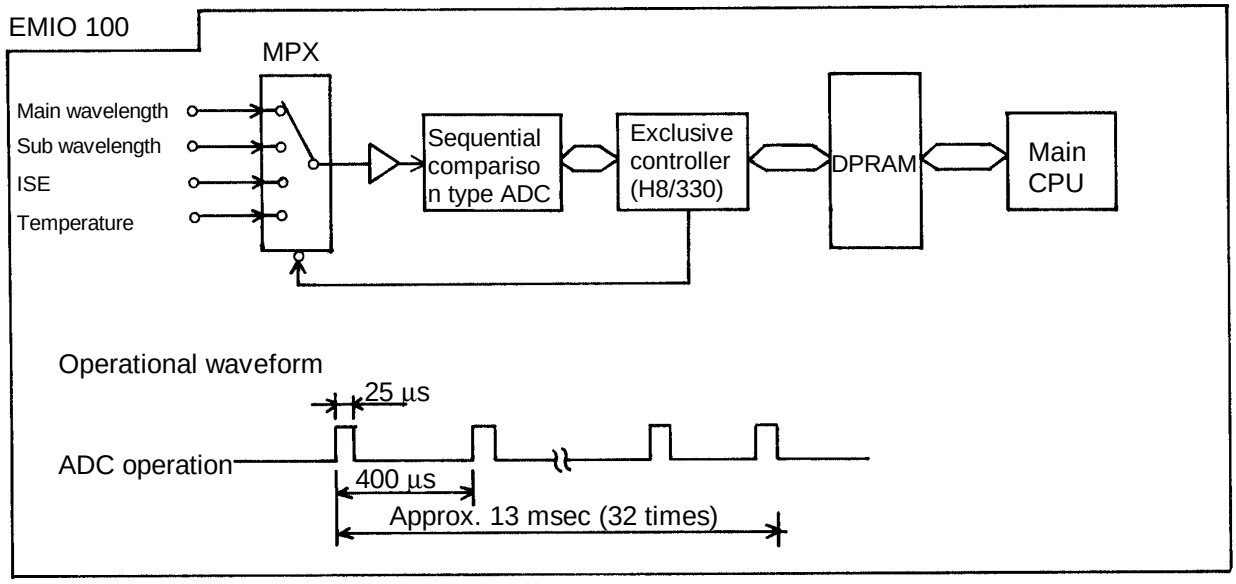
*) VR1 and VR2 are not adjusted after shipment from the factory.
(already adjusted with exclusive tool)

< Differences from Conventional AD System >

Described below are the differences between the ADC mounted on the EMIO100 board and the conventional one by comparing with the ADC-V board.

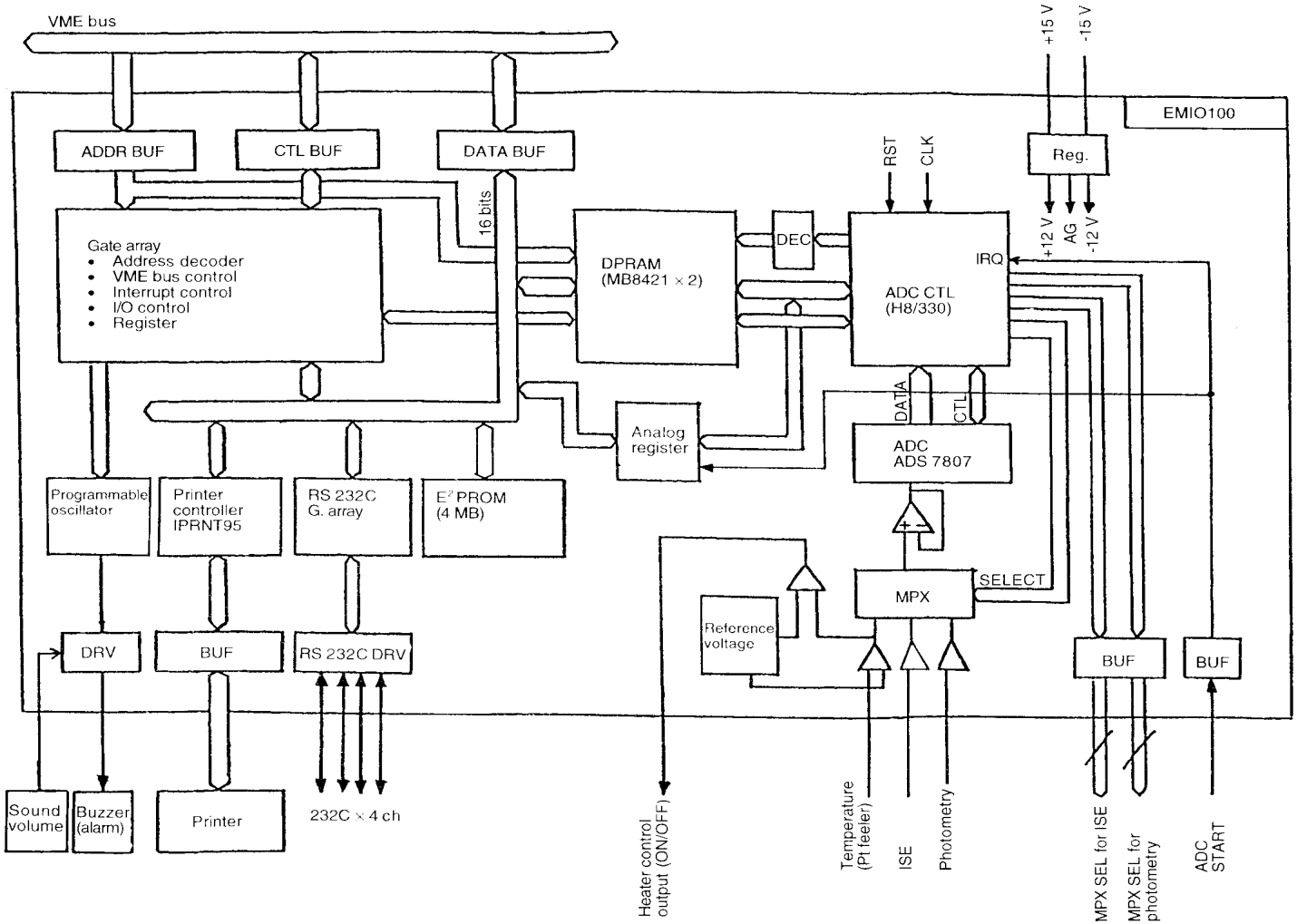
	ADC - V	EMIO100
A/D System	Double integral type	Sequential comparison type
Number of ADCs	2 pcs	1 pc
Number of channels	2 ch	4 ch (switching type)
Data averaging	Analog averaging with integration circuit	Averaging through continuous measurements and calculation





The ADC whose conversion rate is 25 µsec is operated at intervals of 400 µsec 32 times and from the data thus obtained, the maximum and minimum values are deleted.
After that, the average value is calculated and output to the main CPU as a 16-bit A/D value.
In case of simultaneous measurement at two wavelengths, the above operation is conducted while changing the MPX at intervals of 200 µsec and two 16-bit A/D values separately calculated in H8 for the main and sub wavelengths are output.

Block Diagram of EMIO100 Board



10.4 EMOT200 Board

(1) Explanation of Circuit Board

The EMOT200 board is a mechanism control board mounting one GMCONT and eight GPCONTs which are one-chip motor controllers (hereafter referred to as MCU) and conforming to the VME bus standard. By mounting the MCU to the specified position on the EMOT200 board, the MODE pin of MCU is set for function selection. Each GPCONT controls two stepping motors.
The circuit board is provided with the watchdog timer function and when the CPU is abnormal, all controllers are reset to prevent the mechanism from running out of control.

(2) Number of Controls

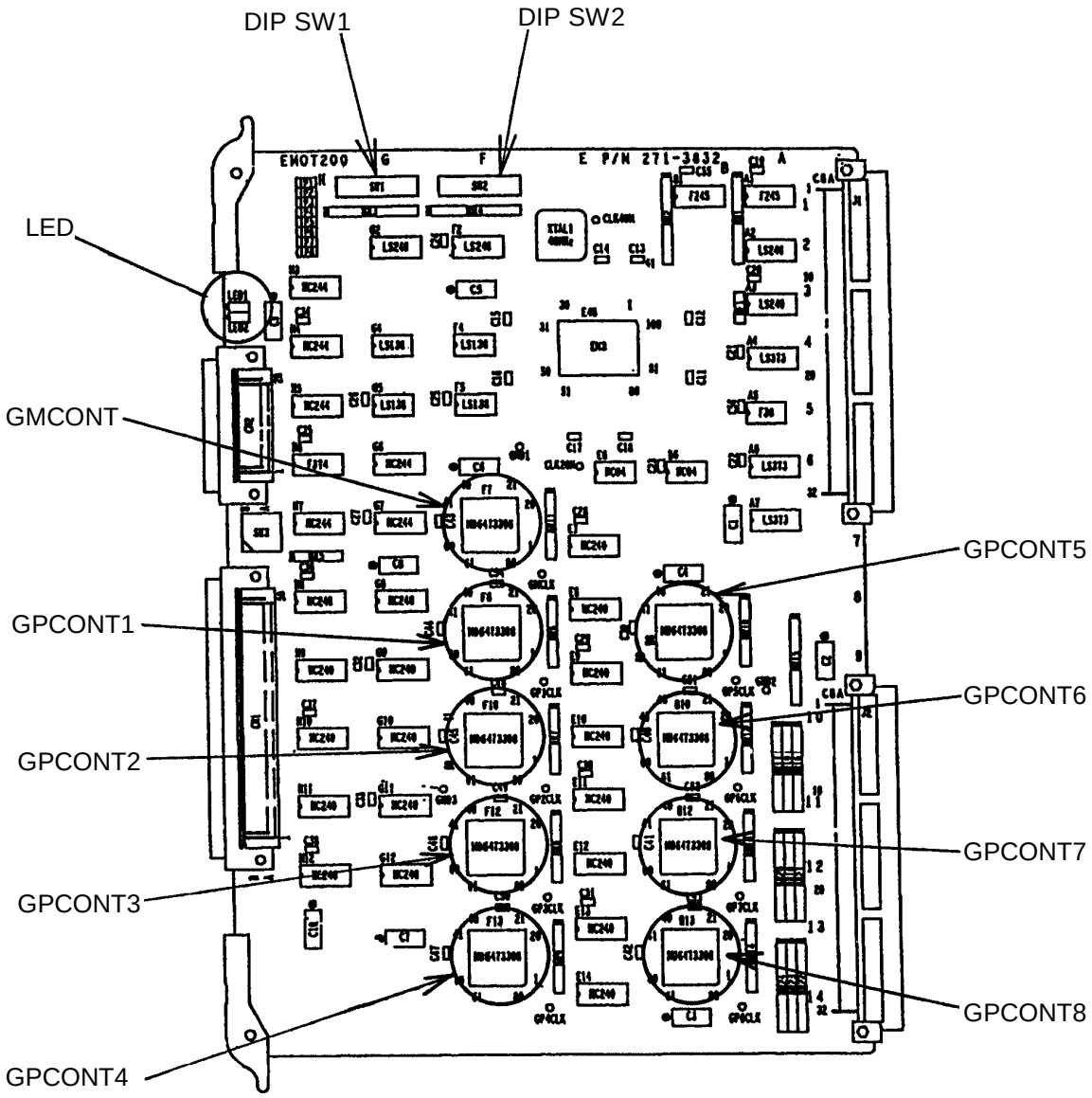
Each GPCONT can control two two-phase stepping motors and accept four interrupt inputs (limiter inputs) for each motor. Eight MCUs (for 16 motors) are assigned to the EMOT200 board as exclusive controllers for two-phase stepping motors.
One GMCONT is equal to two conventional MTCONTs. Namely, each GMCONT can control sixteen D/I's and D/O's. And eight D/O's for which the timer is unprogrammable are available.
One GMCONT is assigned to the EMOT200 board.
The following table shows the number of controls by the EMOT200 board.

Number of Controls by EMOT200 Board

	Designation	Q'ty
GPCONT	2-phase stepping motor output *1 Limiter input	16 16 × 4
GMCONT	D/O (timer programmable) D/I	16 16
	D/O	8
Other	D/O	8 bits
	CPUDI × 8	8 × 8 bits
	DI for DIP SW × 2 *2	16 bits

*1 Phase output and power save signal
*2 Switch for software setting

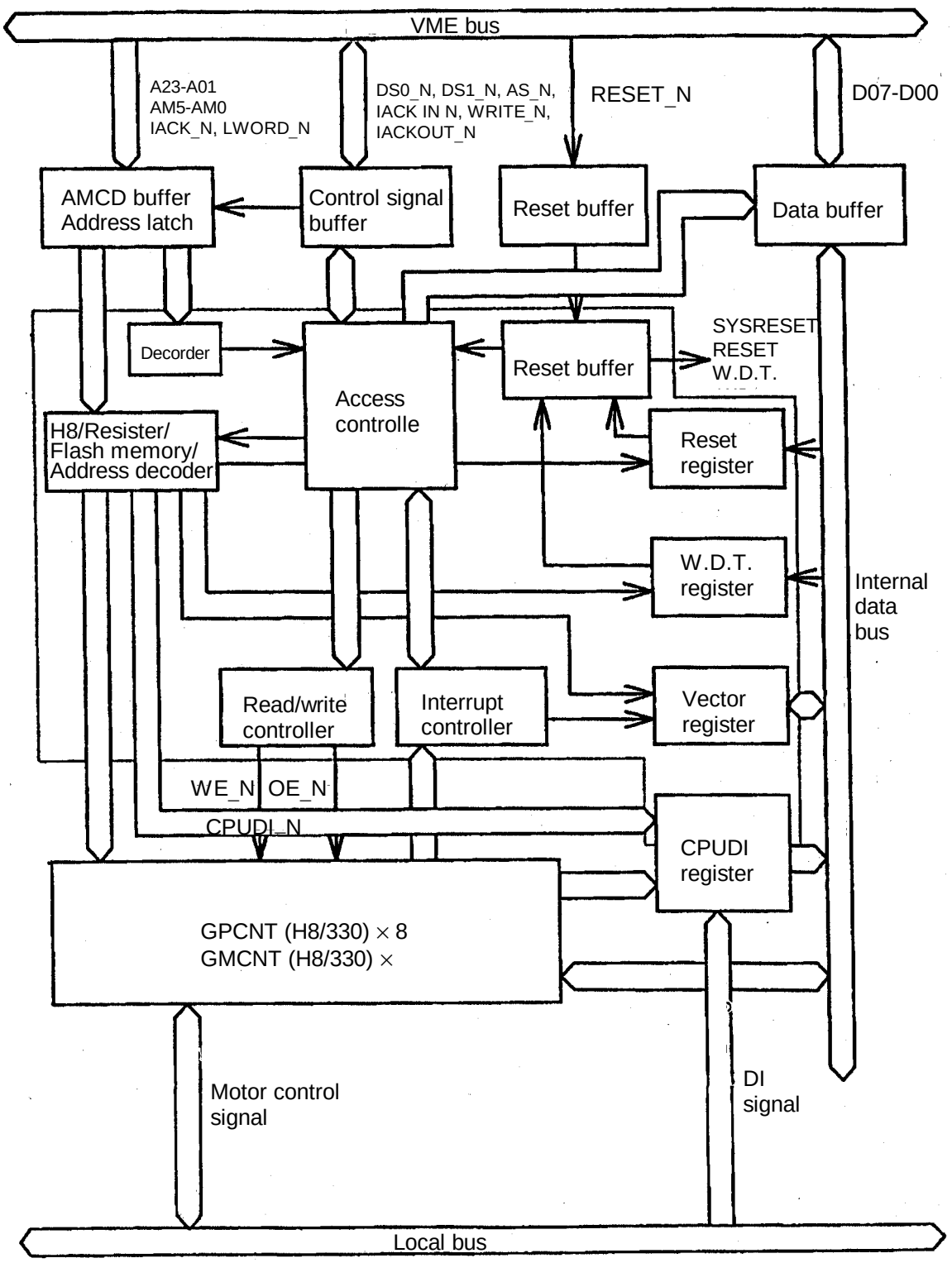
(3) External View



Explanation of LED

No.	Name	Description
1	LED1 (green)	Lit upon generation of interrupt from any of GPCONT1 to GPCONT4 and GMCONT to master CPU.
2	LED2 (green)	Lit upon generation of interrupt from any of GPCONT5 to GPCONT8 to master CPU.

Block Diagram of EMOT200 Board



10.5 MVSB100 Board

(1) Explanation of Circuit Board

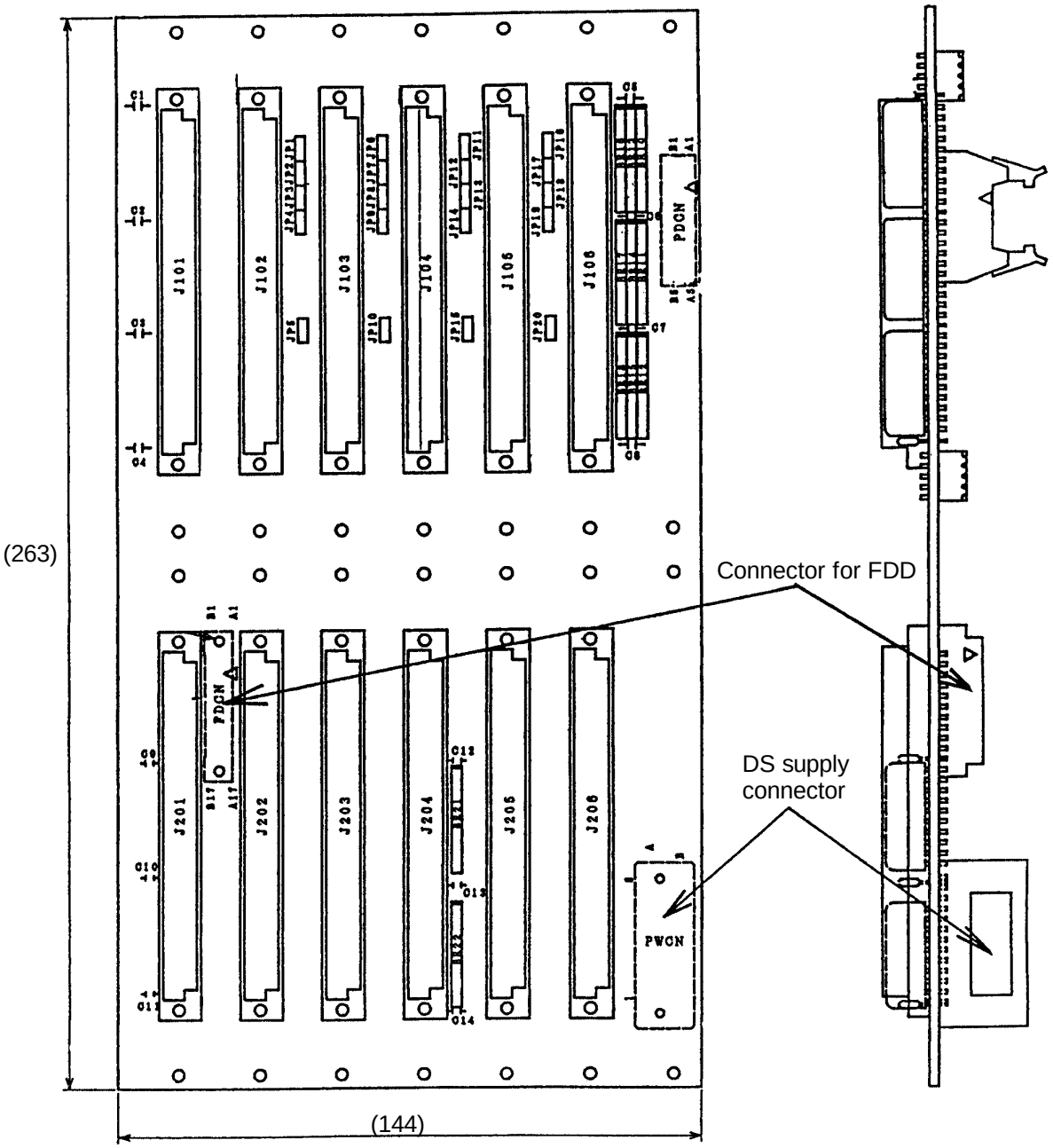
This circuit board is a mother board which is compatible with the VME bus and has six slots.

(2) Arrangement of Circuit Boards

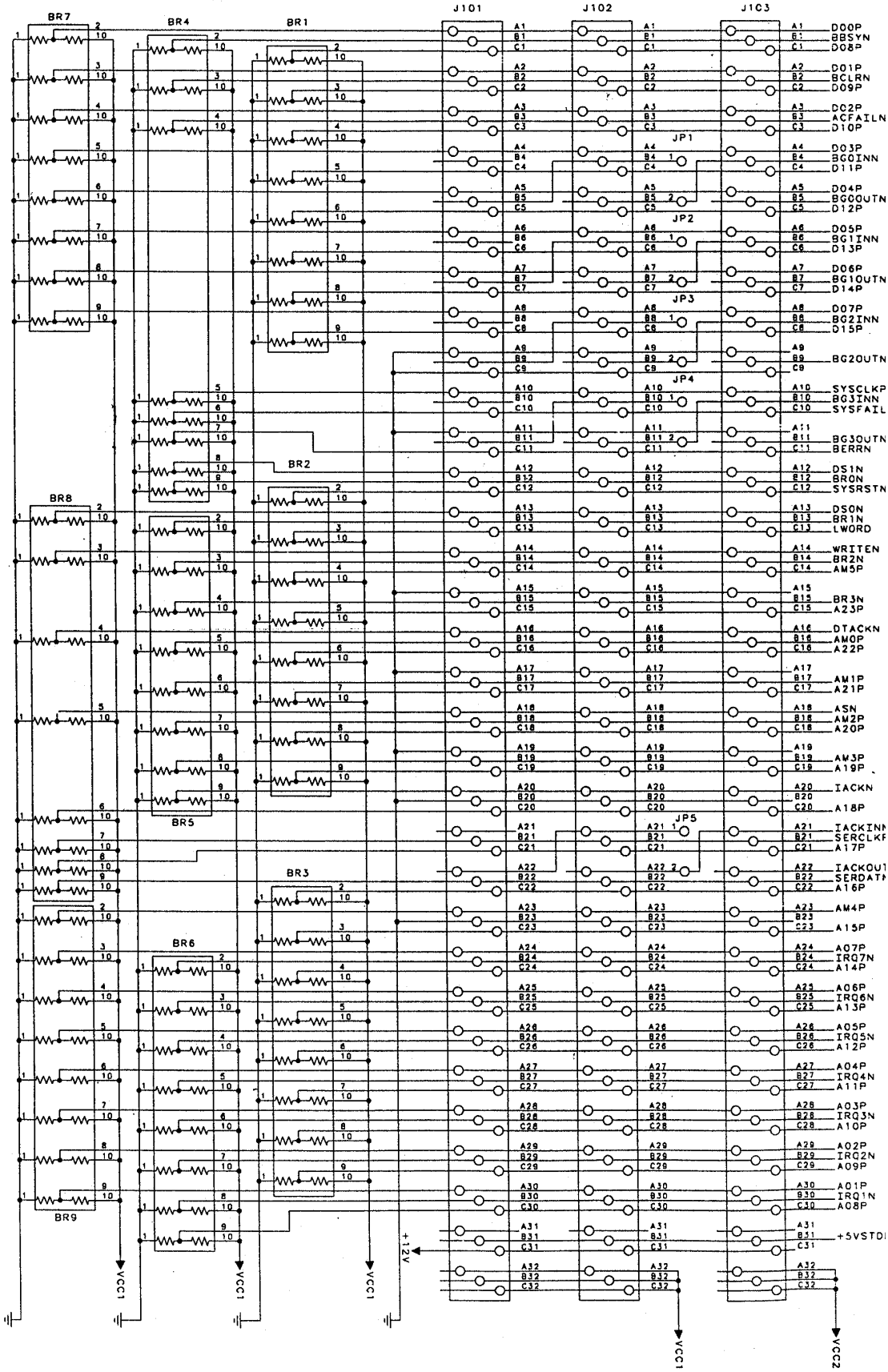
Slot No.	Circuit Board
1	ECPU 237
2	Unused
3	Unused
4	EMIO100
5	EMOT200
6	DI

NOTE: Slot no. 1 is located at the left as viewed from the front.

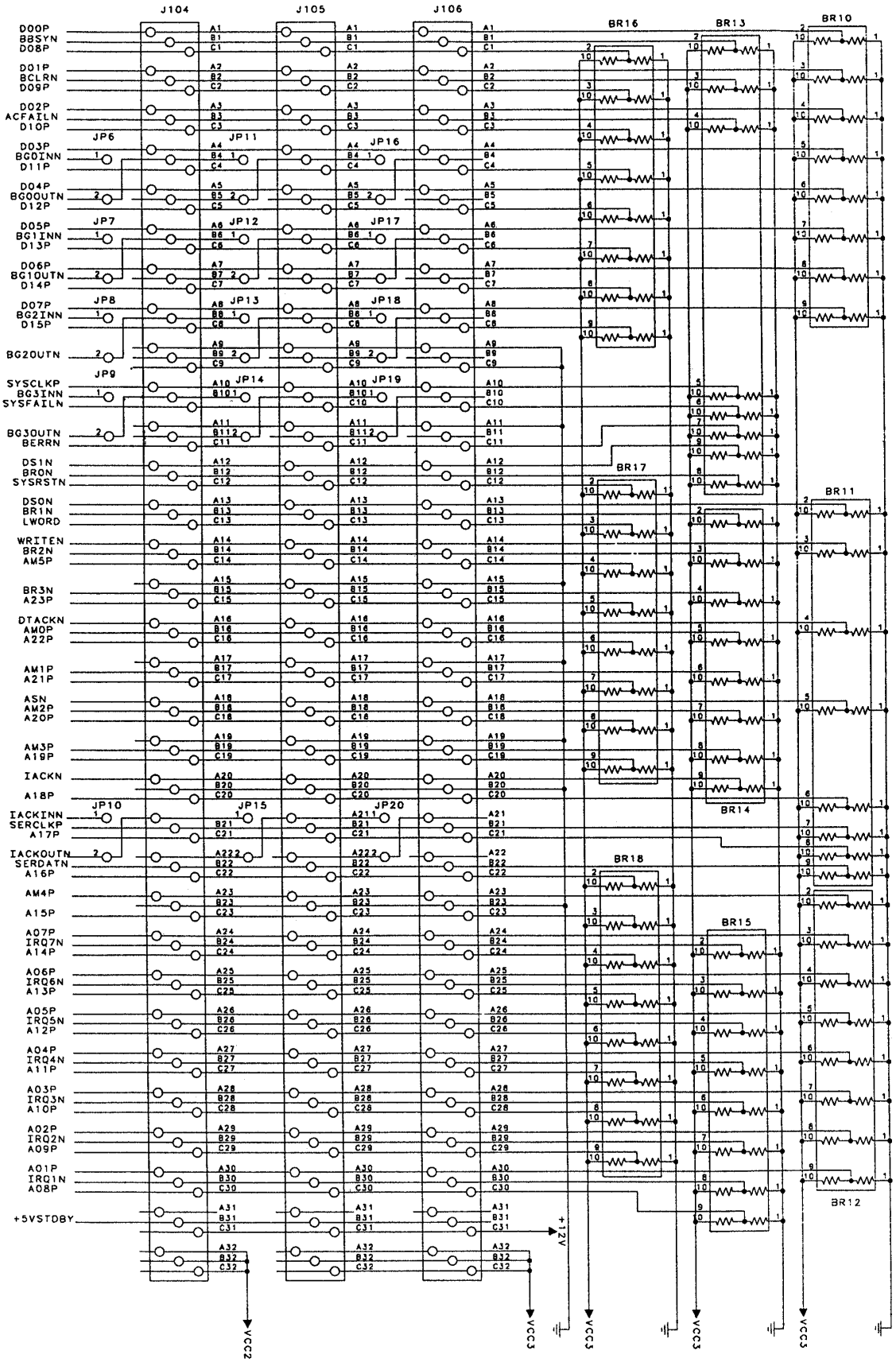
(3) External View



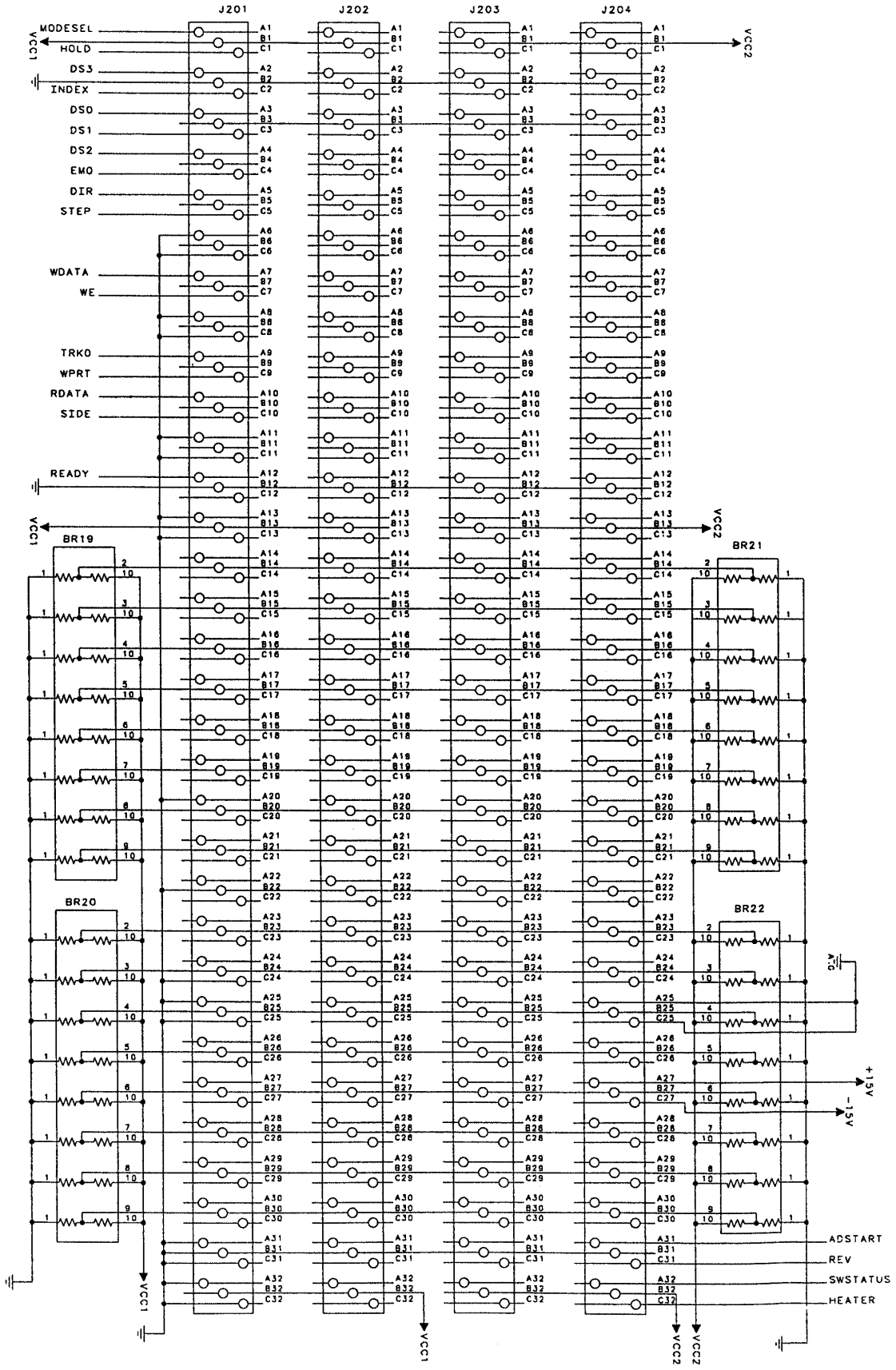
VRT - 250 MVSB100 (1/5)



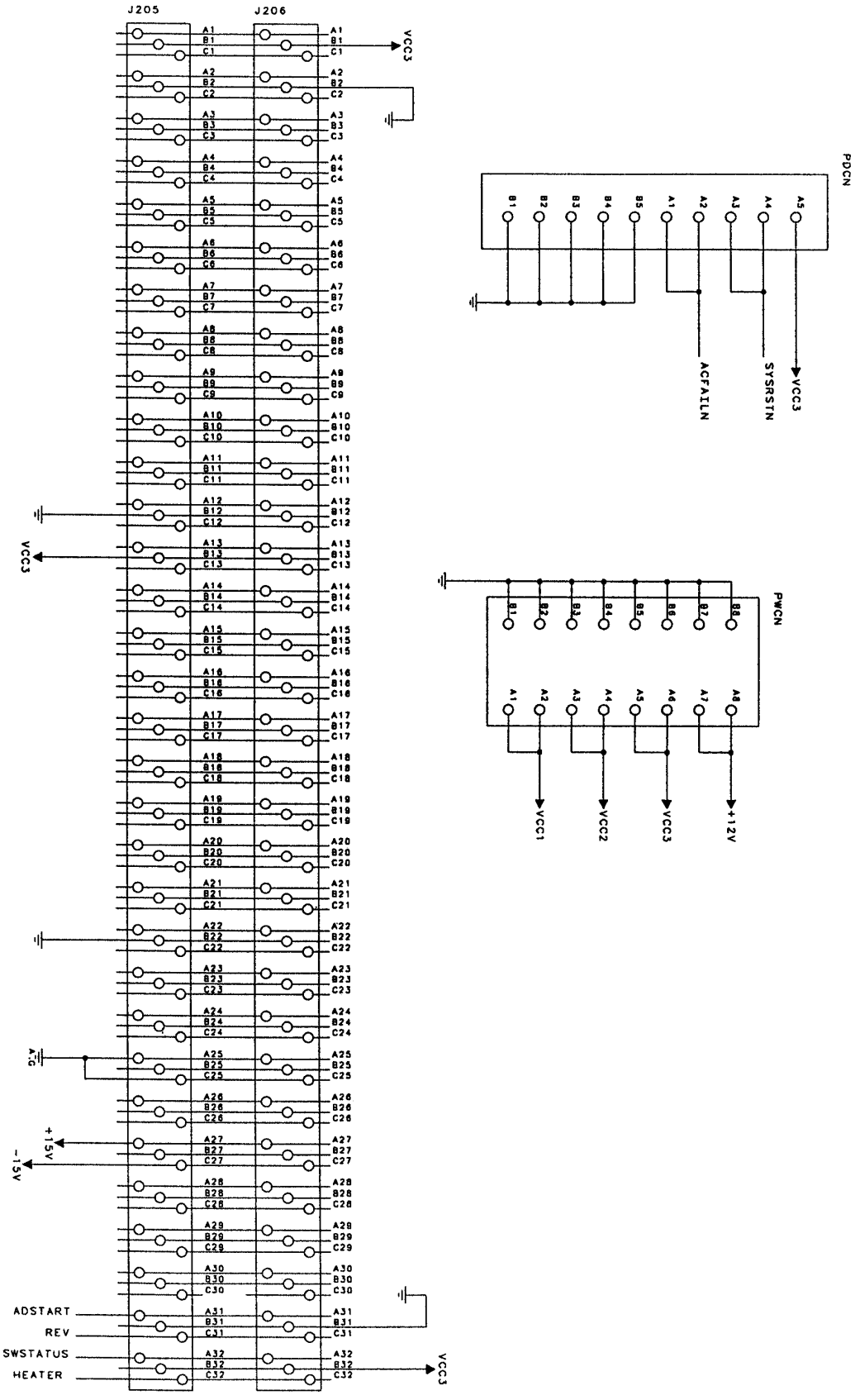
VRT - 250 MVSB100 (2/5)



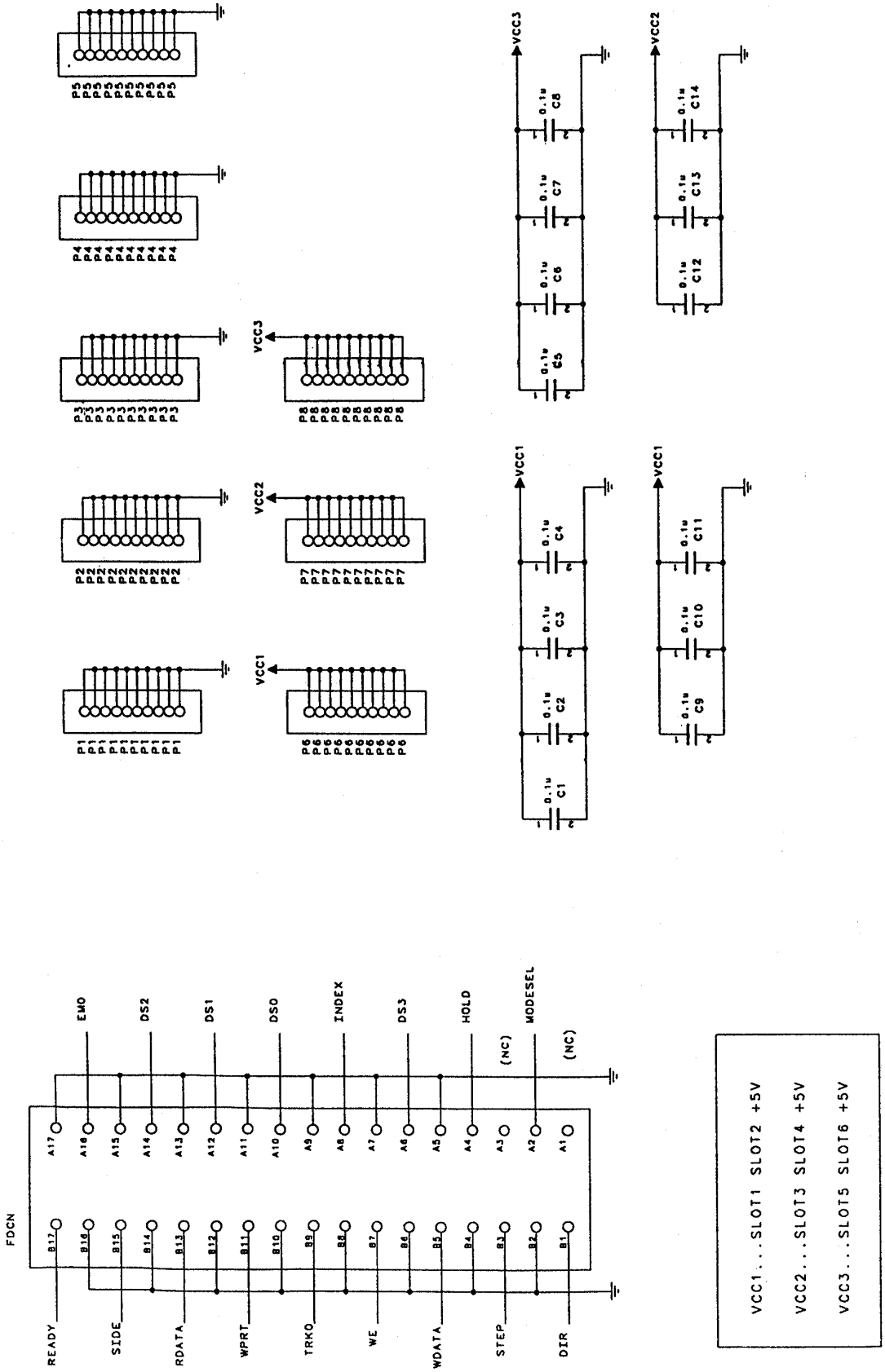
VRT - 250 MVSB100 (3/5)



VRT - 250 MVSB100 (4/5)



VRT - 250 MVSB100 (5/5)



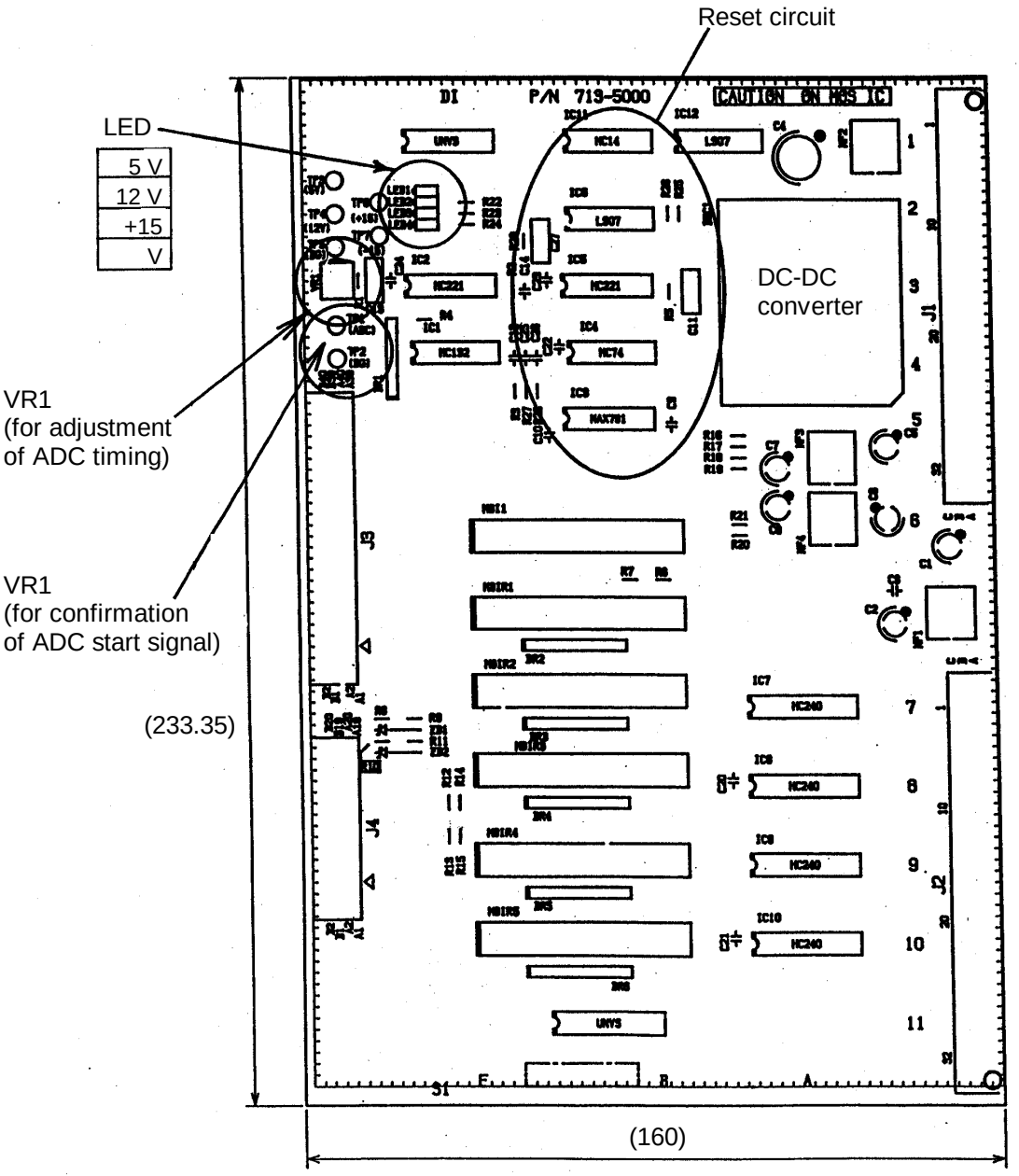
10.6 DI Board

(1) Explanation of Circuit Board

This circuit board is a buffer board for waveform shaping of input signals of sensors (photo-interrupter, water level sensor, etc.) and has the following functions.

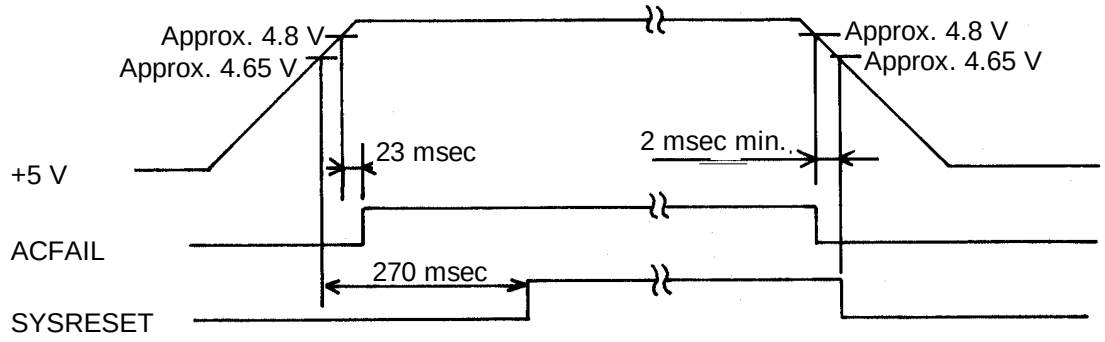
- Reset circuit (SYSRESET/ACFAIL signal supply to VME bus)
- Generation of ADC timing signal for photometry hardware trigger
- DC voltage monitoring (±15 V, 12 V)
- Generation of ±15 V voltage for analog use (DC-DC converter)

(2) External View



(3) Reset Circuit

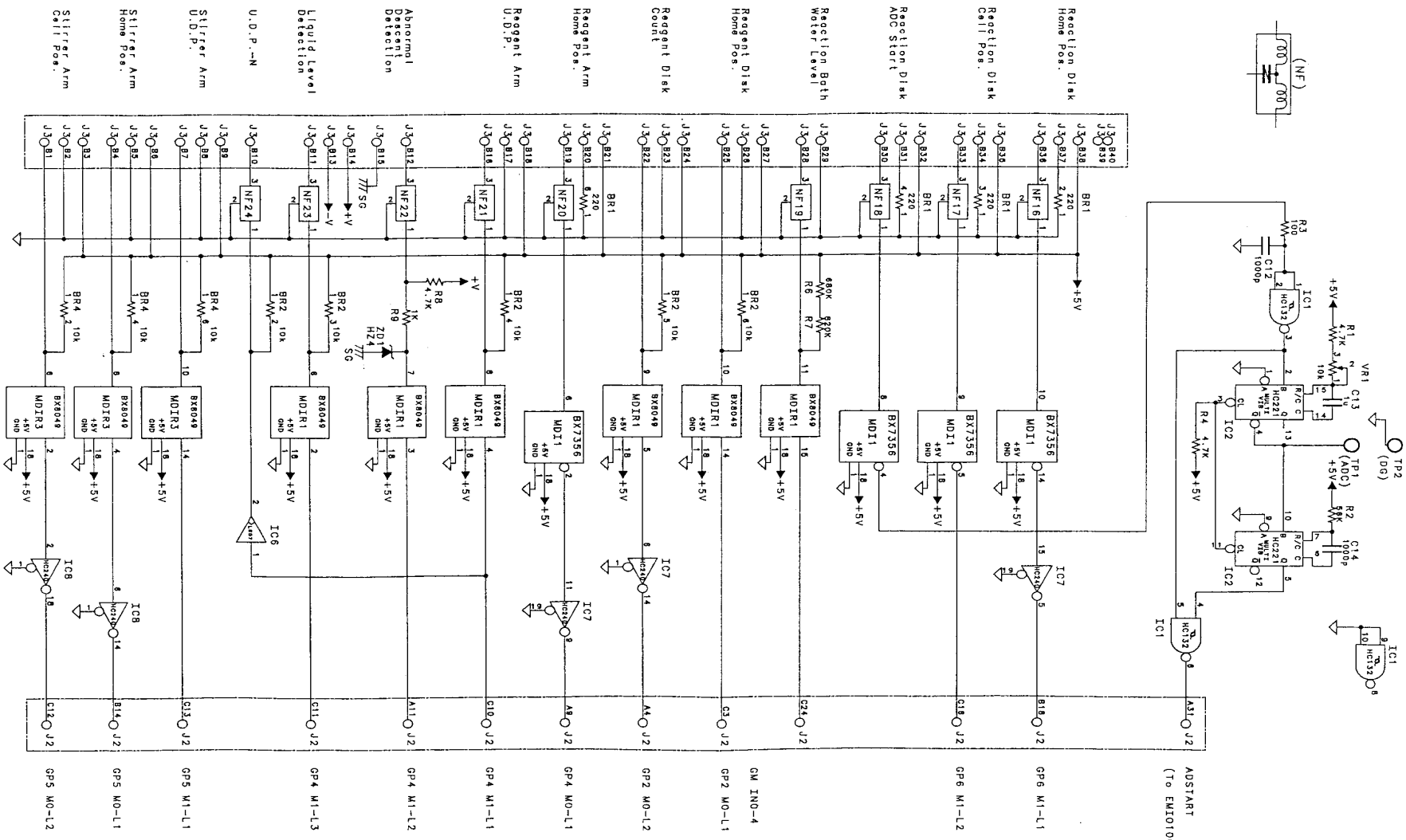
This board supervises the Vcc (+5 V) voltage with the power monitoring IC and generates a reset sequence signal (ACFAIL/SYSRESET) for the main CPU at power on/off.



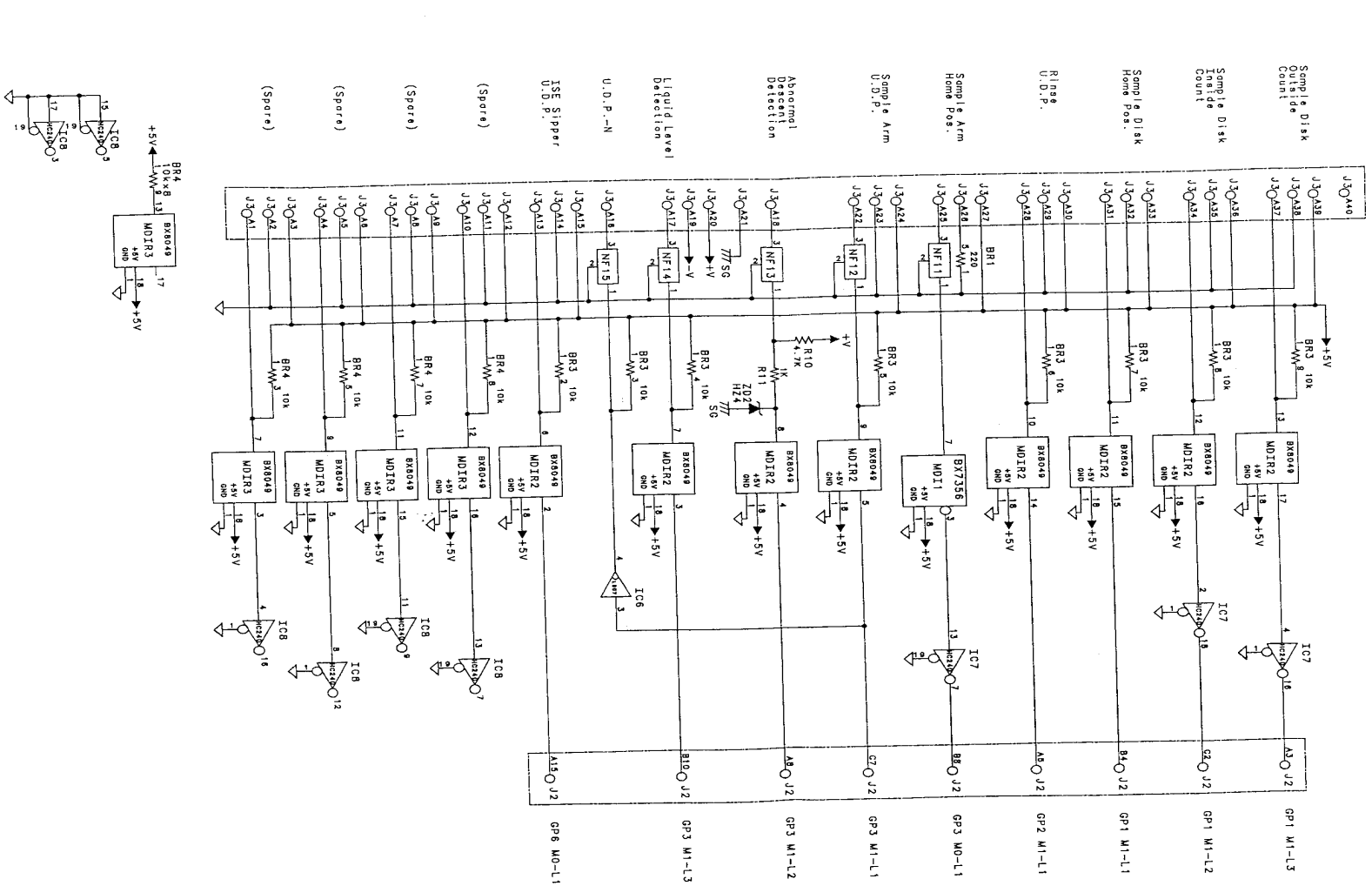
(4) Generation of ADC Timing Signal

The output from the photo-interrupter for ADC start set to the reaction disk is connected to the ADC controller on the EMIO100 board via the delay circuit on this board.
For adjustment of the ADC timing, use the VR1 arranged at the front.

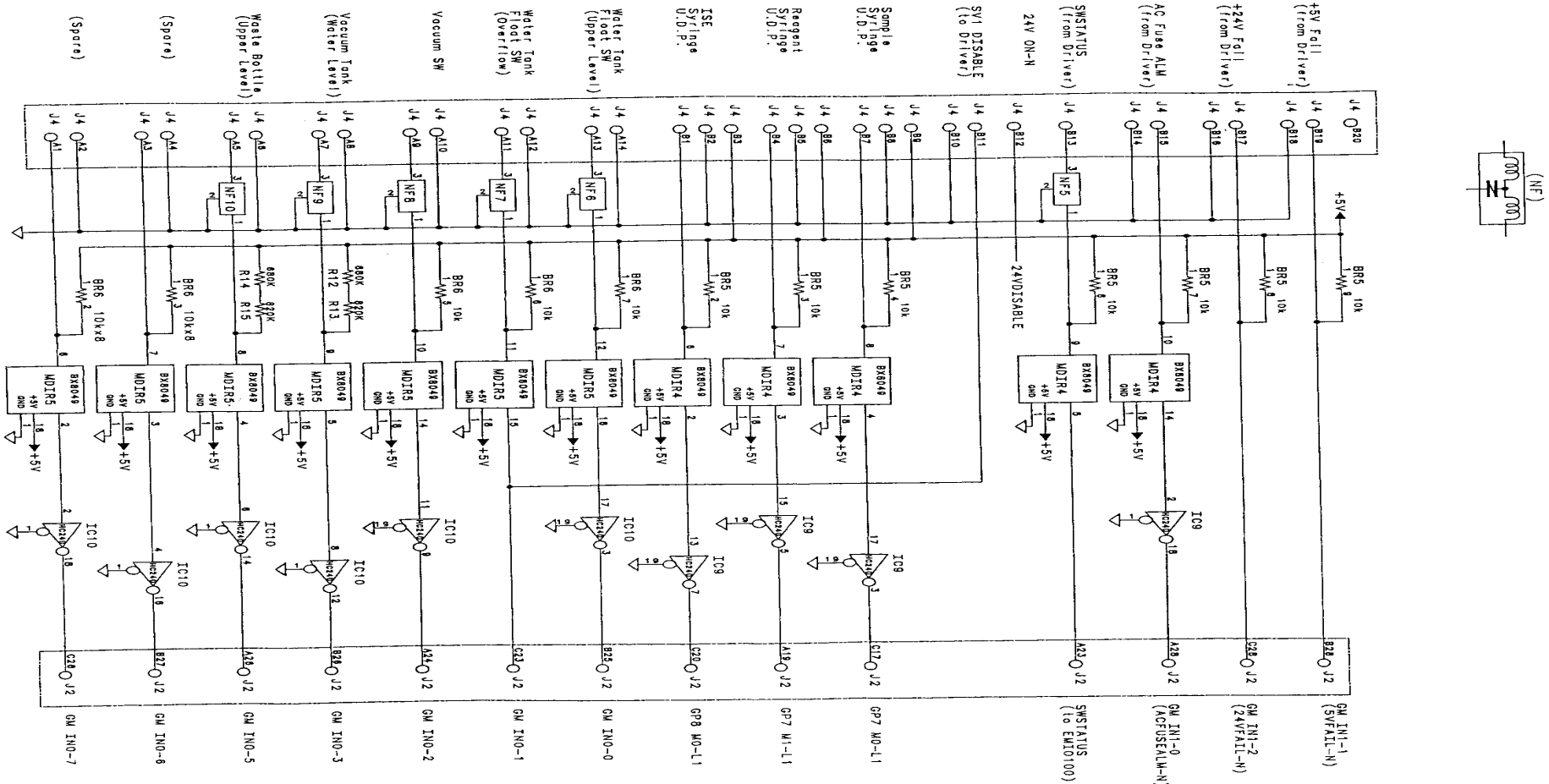
DI Circuit 27135200 (1/5)



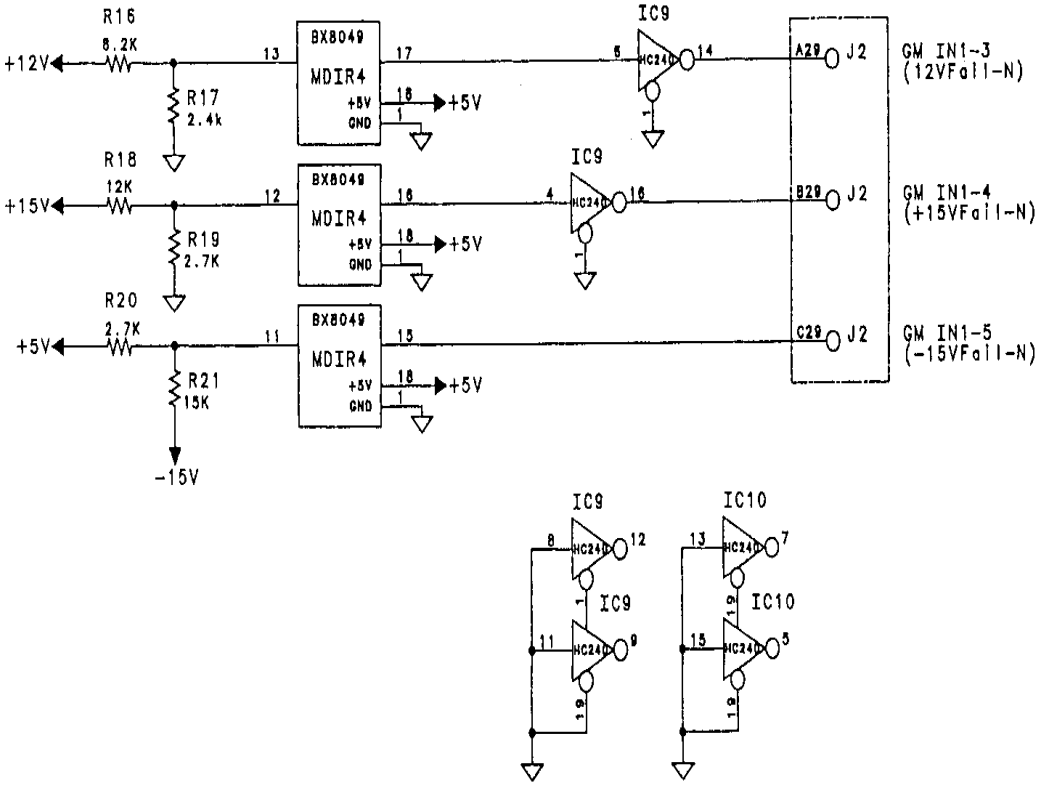
DI Circuit 27135200 (2/5)

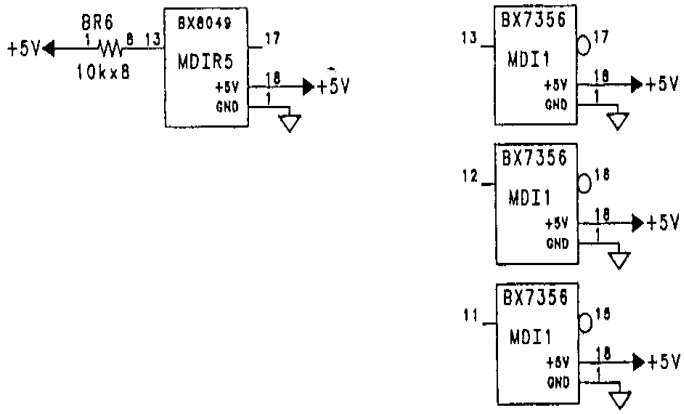


DI Circuit 27135200 (3/5)

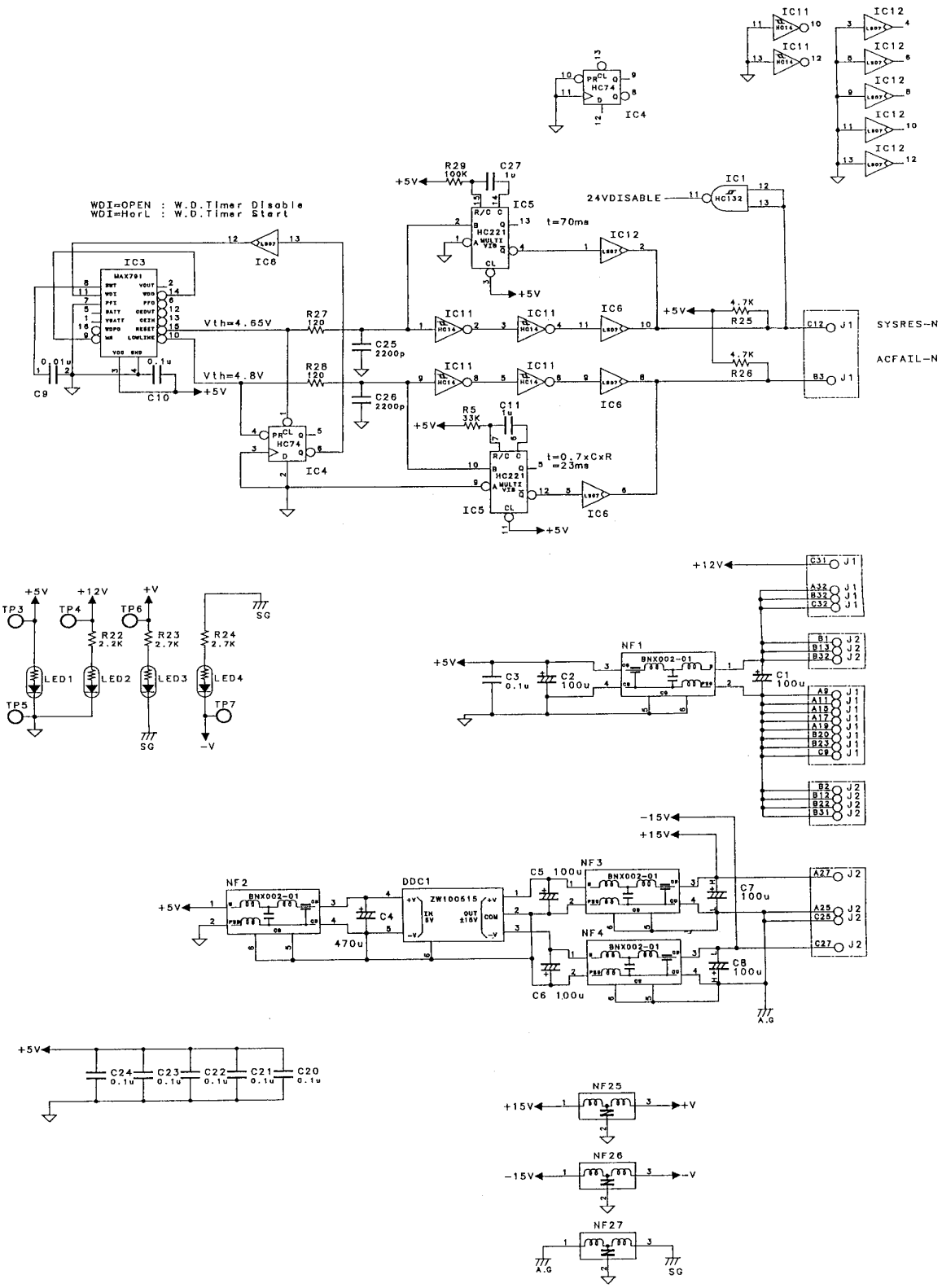


Circuit 271352000 (4/5).





DI Circuit 27135200 (5/5)

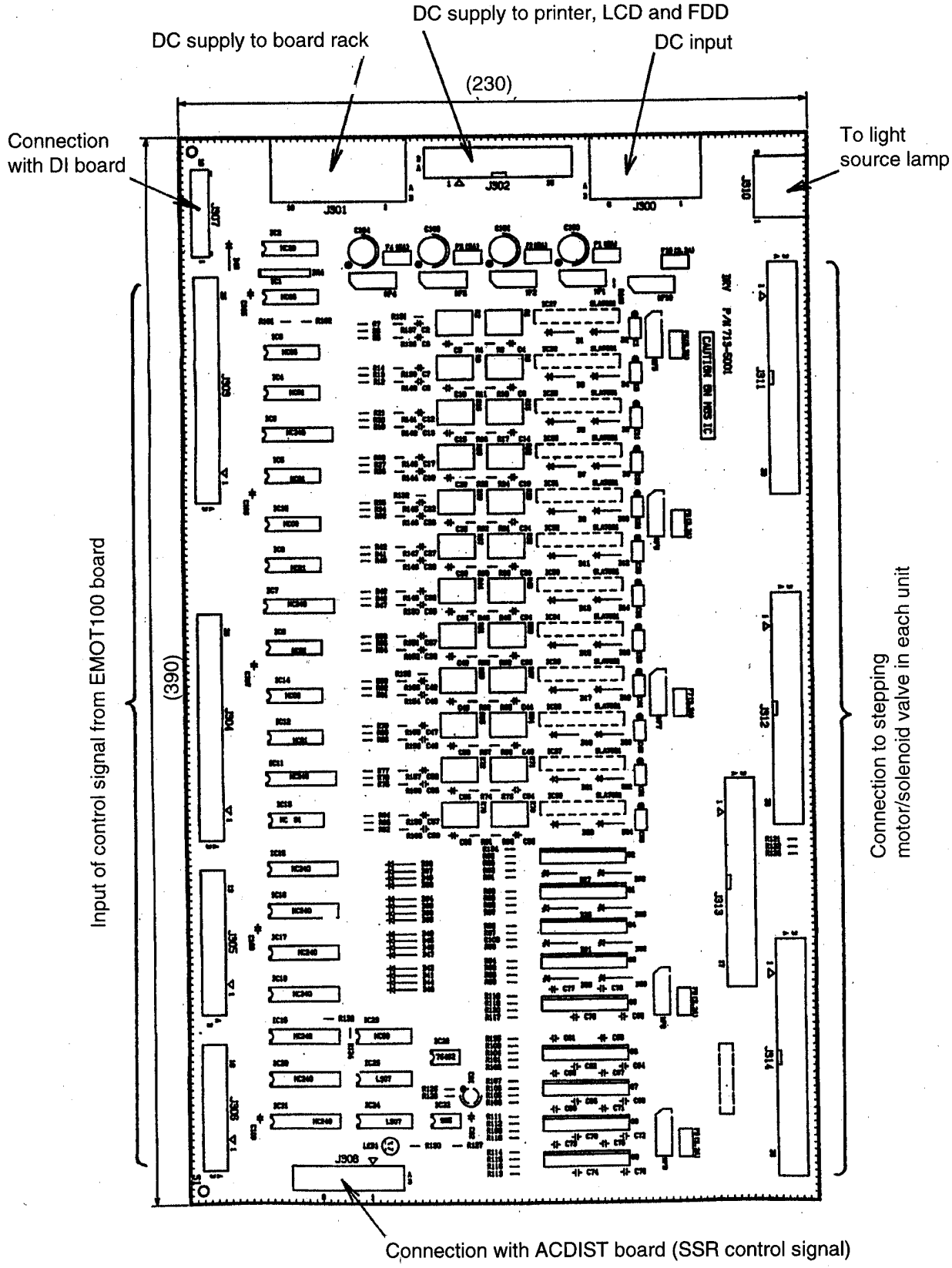


10.7 DRV Board

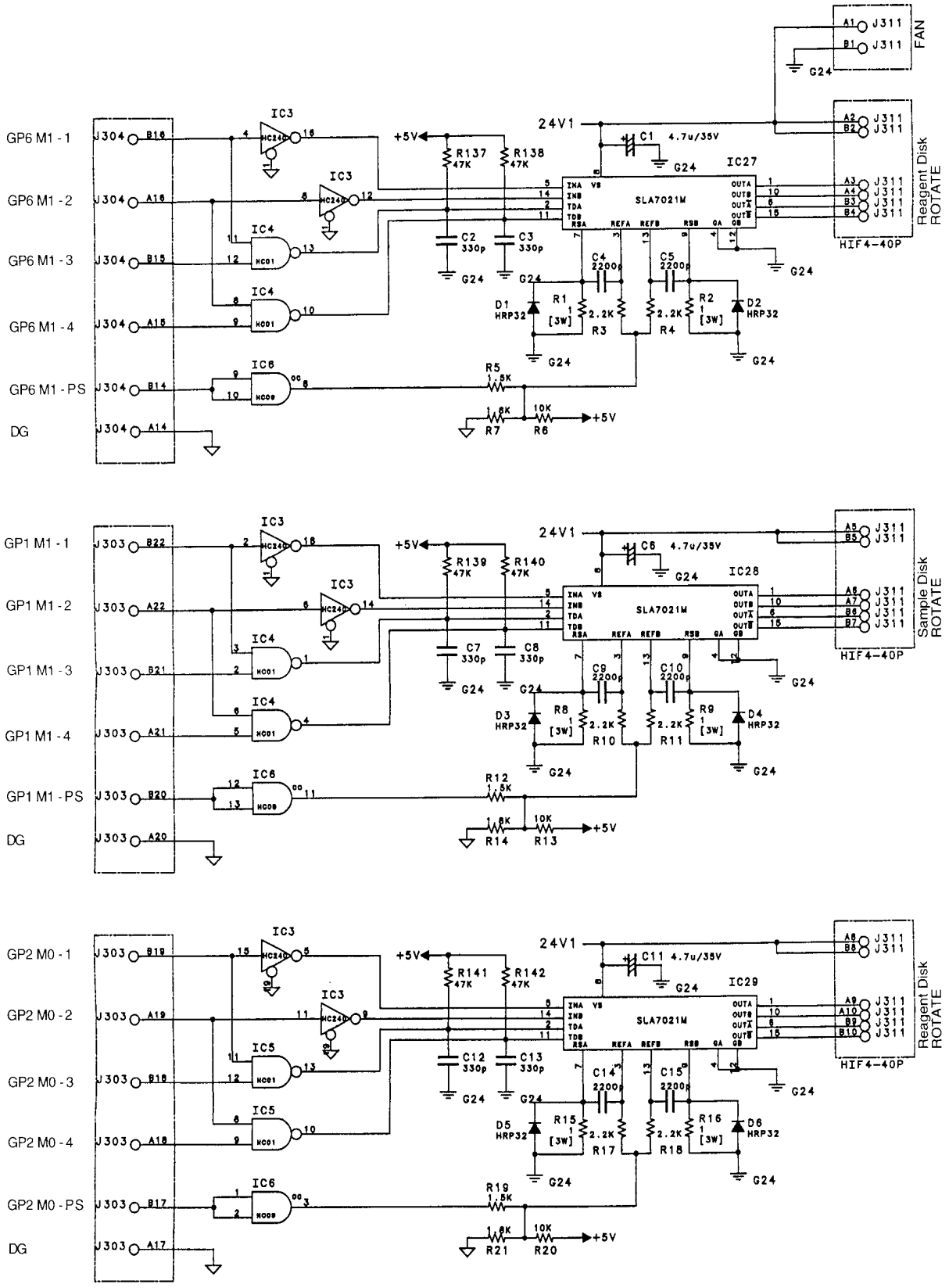
(1) Explanation of Circuit Board

The DRV board drives the stepping motor at a constant current/voltage and the solenoid valve. The SSR control signal from the EMOT100 board is connected to the ACDIST board via this board.
5 V and 24 V DC voltages are supplied to each unit in the instrument from the power unit via this board.

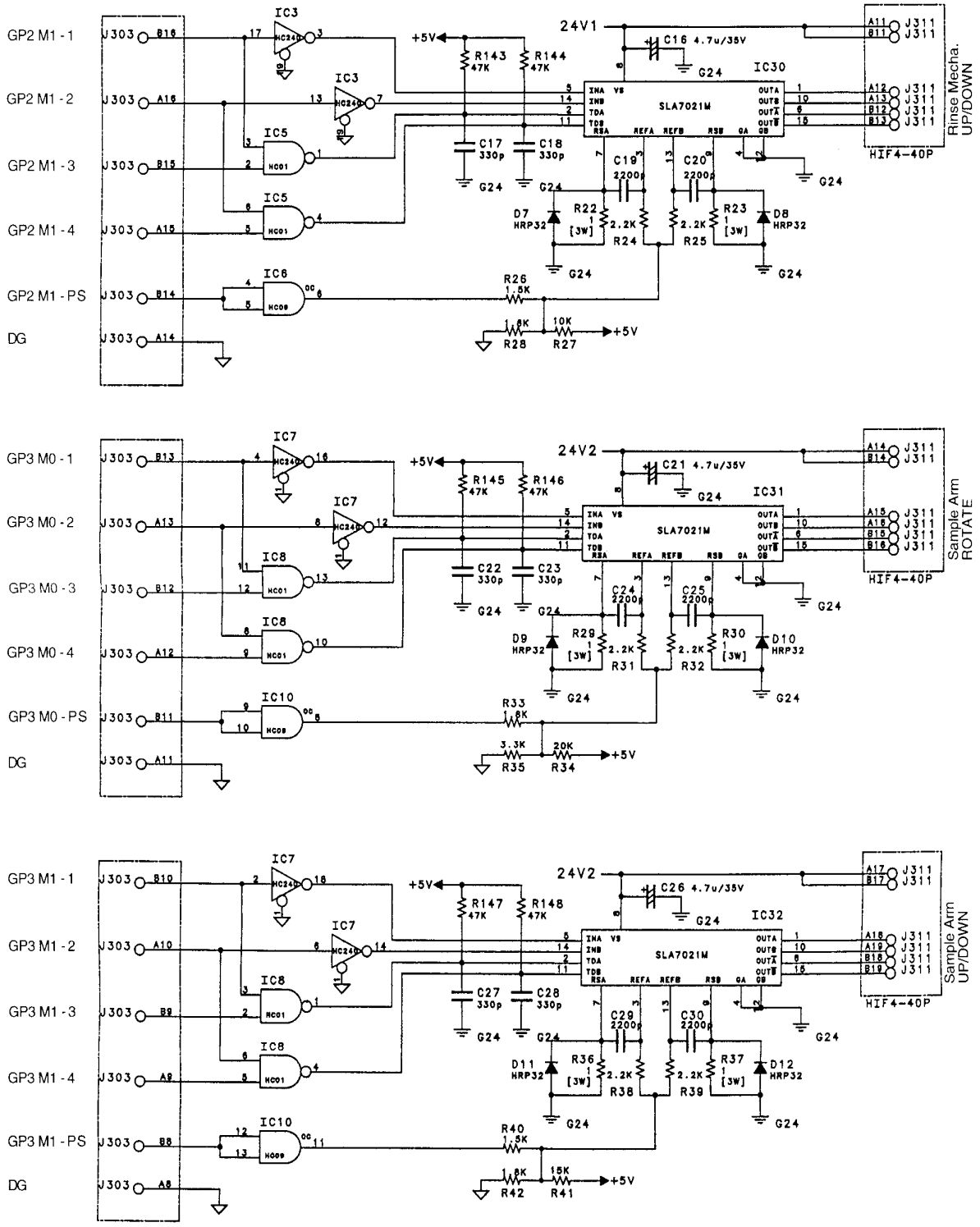
(2) External View


DC supply to printer, LCD and FDD
DC supply to board rack
DC input
(230)
Connection with DI board
To light source lamp
(390)
Input of control signal from EMOT100 board
Connection to stepping motor/solenoid valve in each unit
Connection with ACDIST board (SSR control signal)

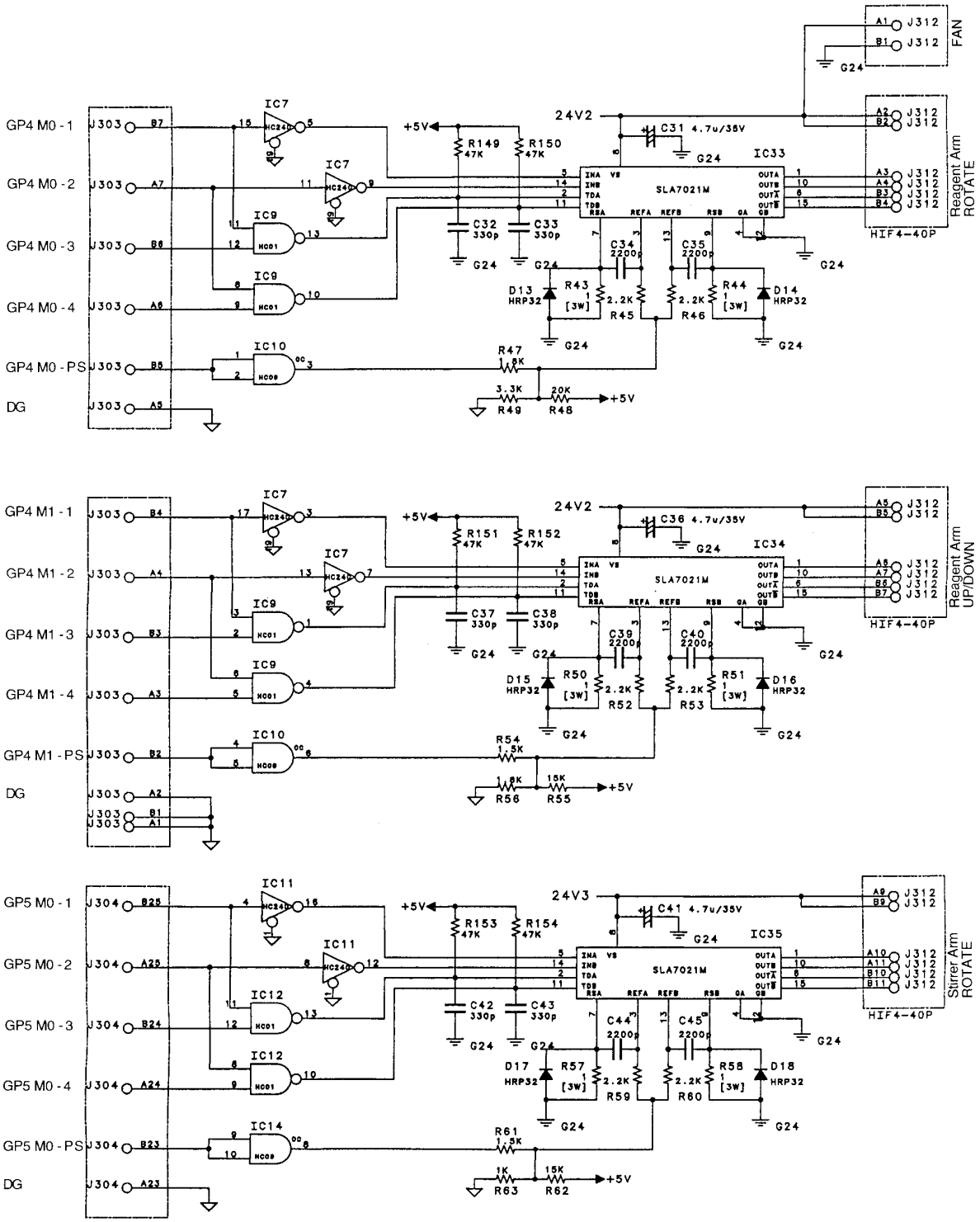
DRV Circuit 27135201 (1/10)



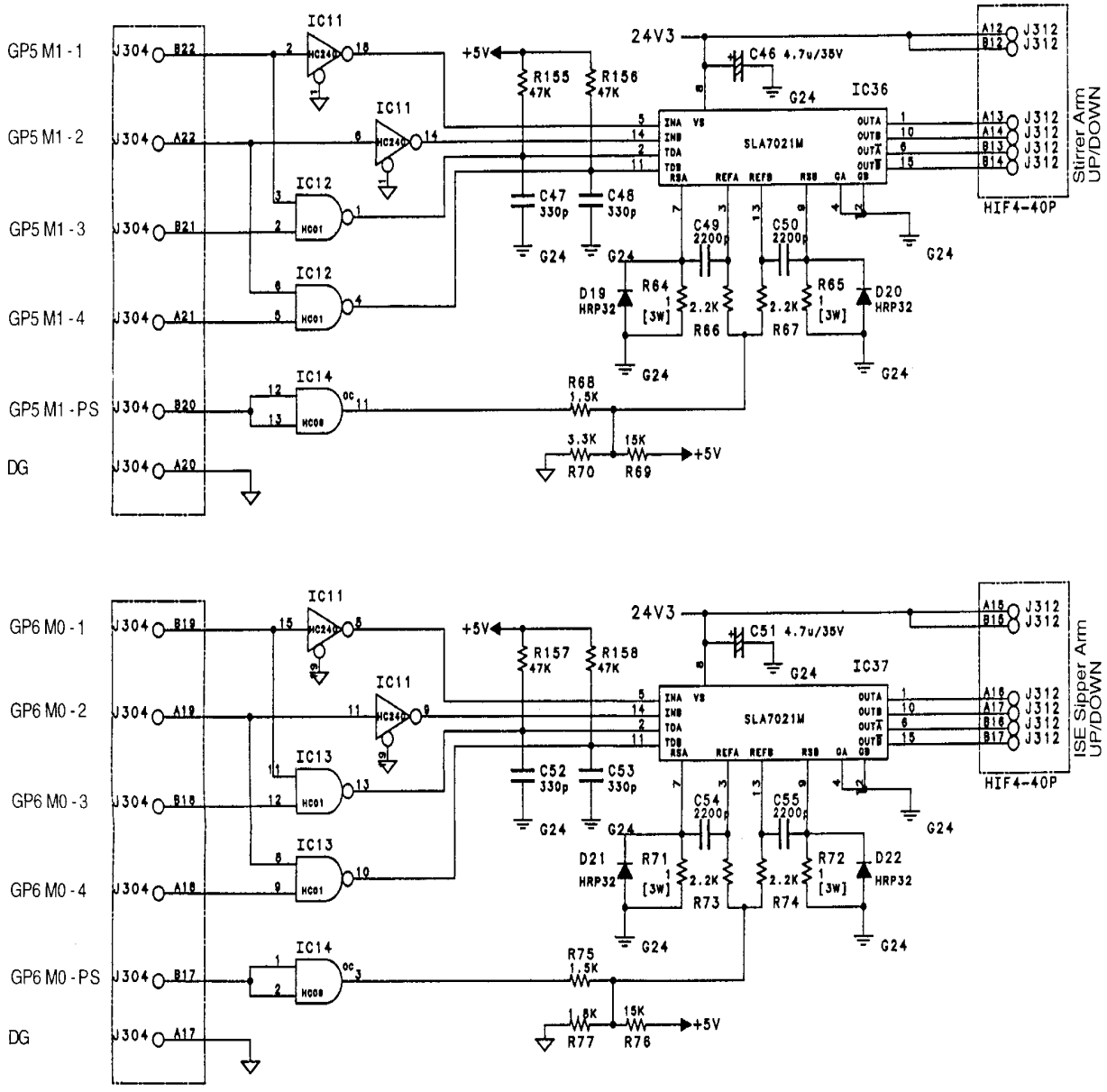
DRV Circuit 27135201 (2/10)



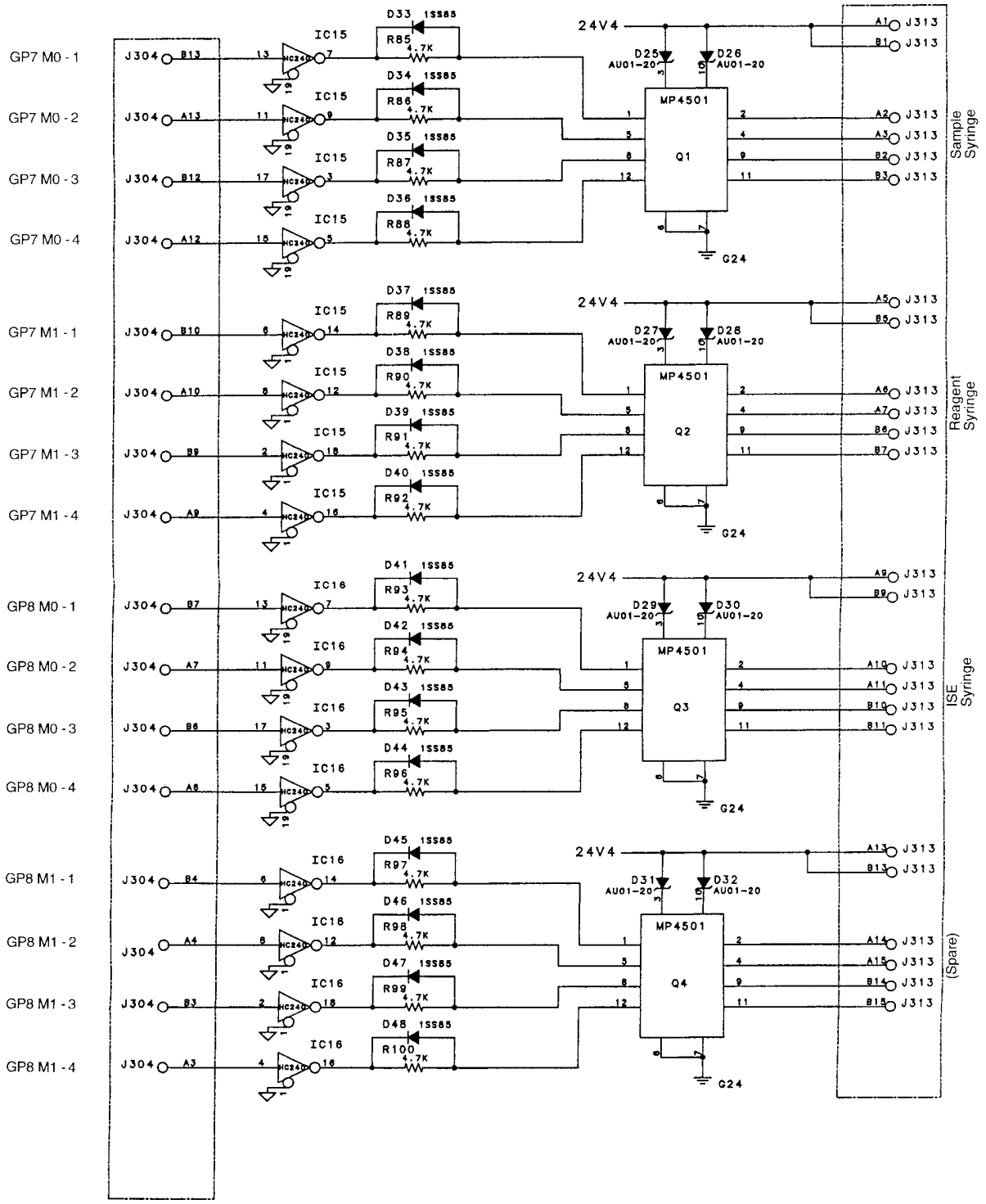
DRV Circuit 27135201 (3/10)



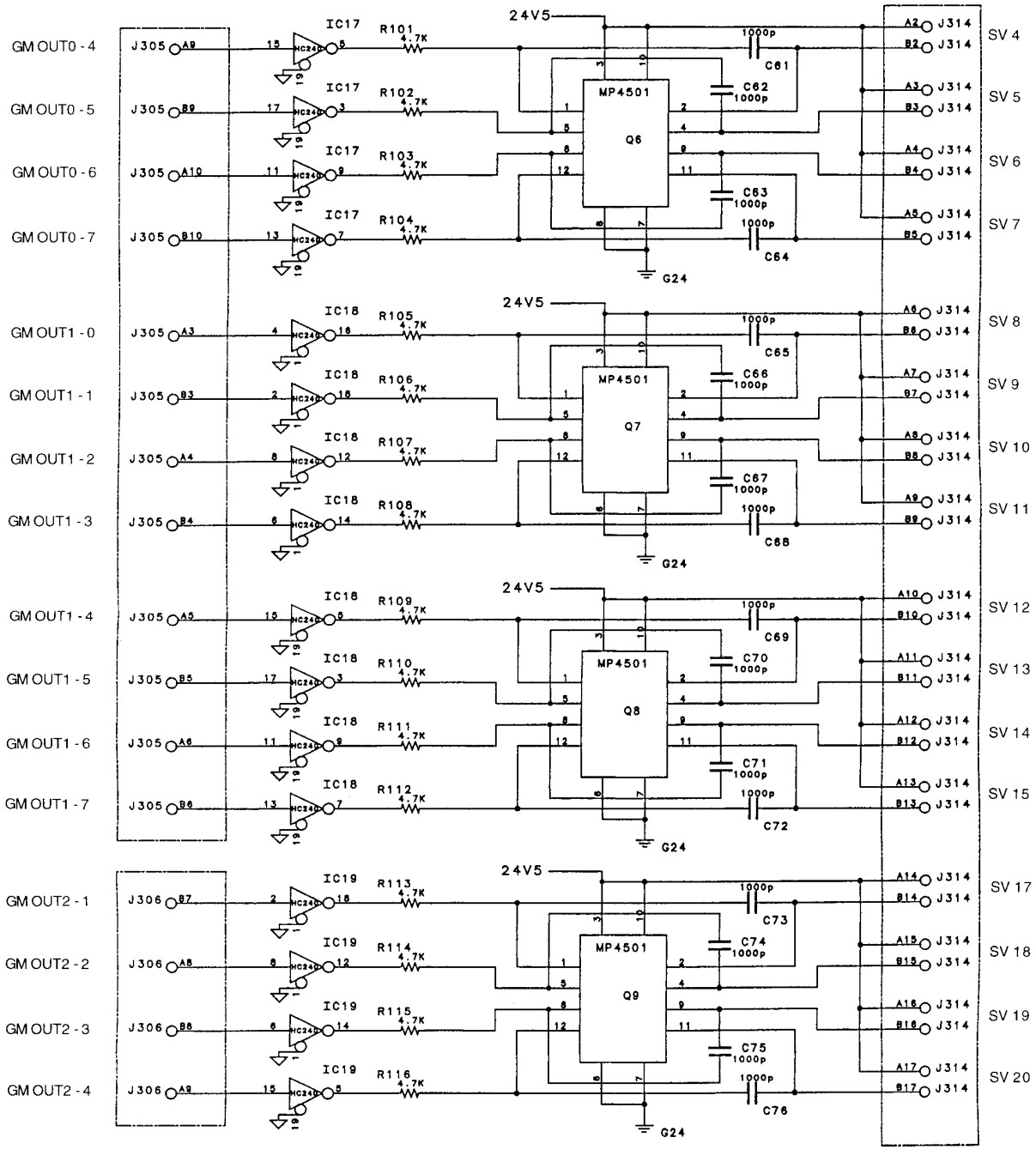
DRV Circuit 27135201 (4/10)



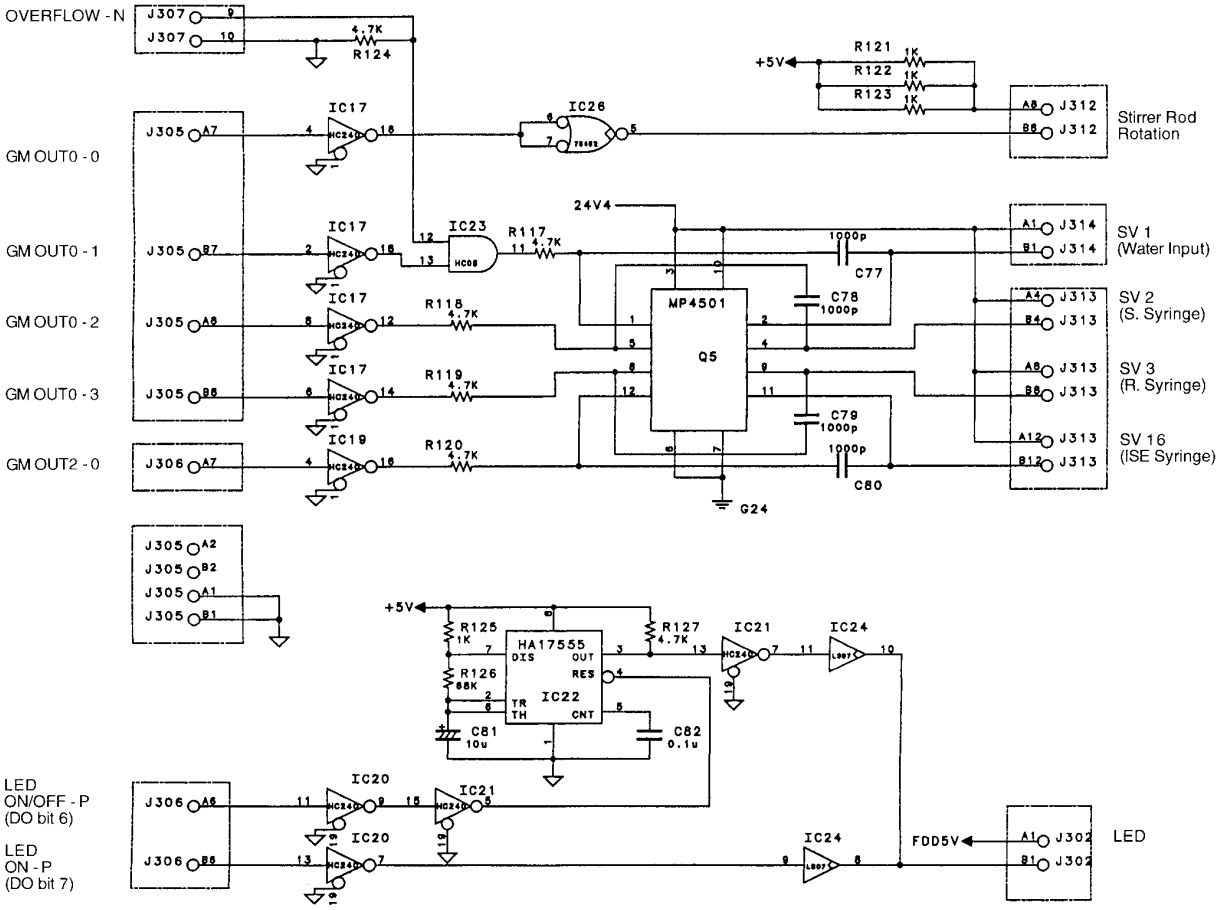
DRV Circuit 27135201 (5/10)

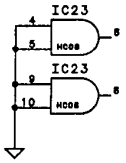


DRV Circuit 27135201 (6/10)

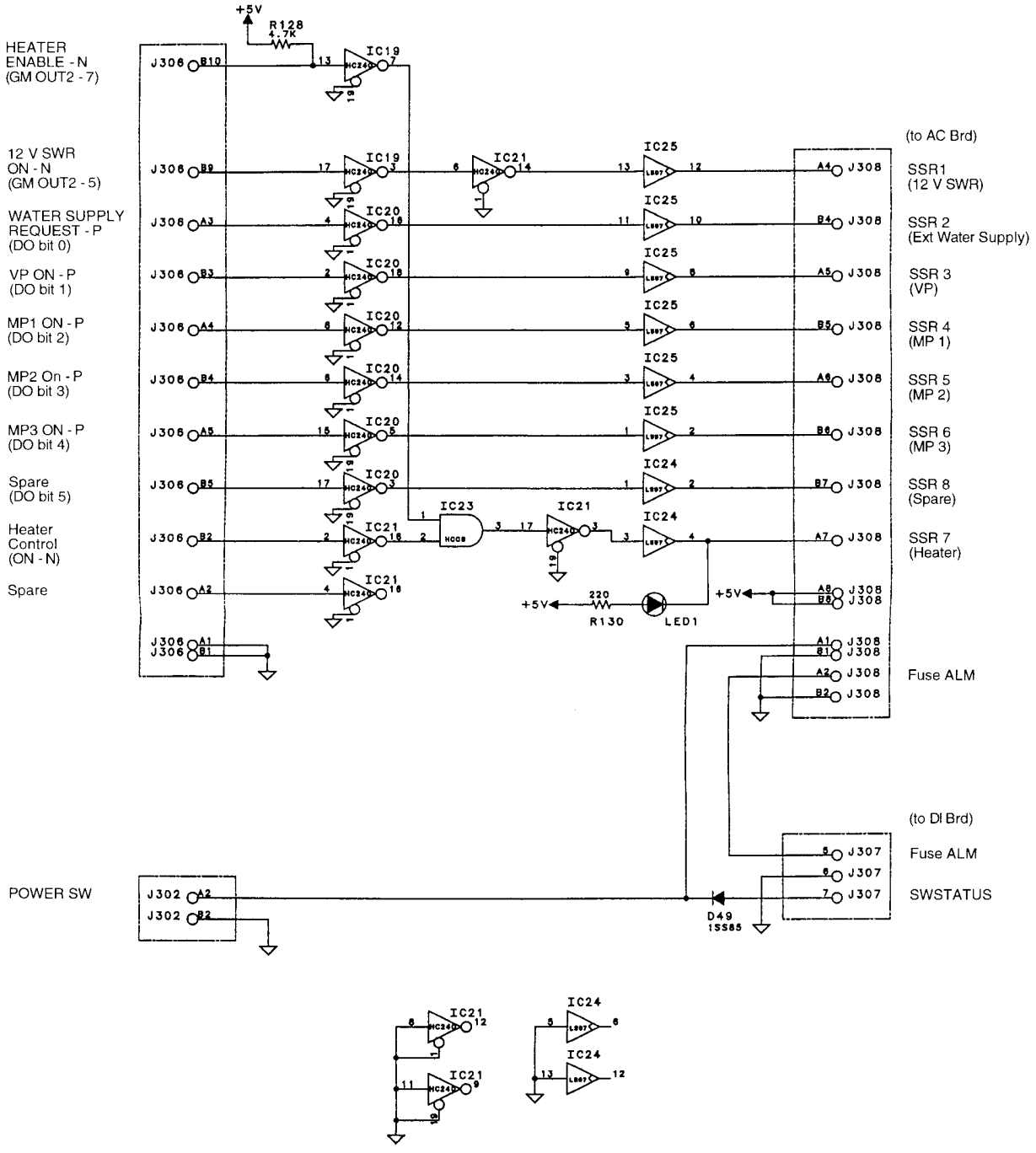


DRV Circuit 27135201 (7/10)

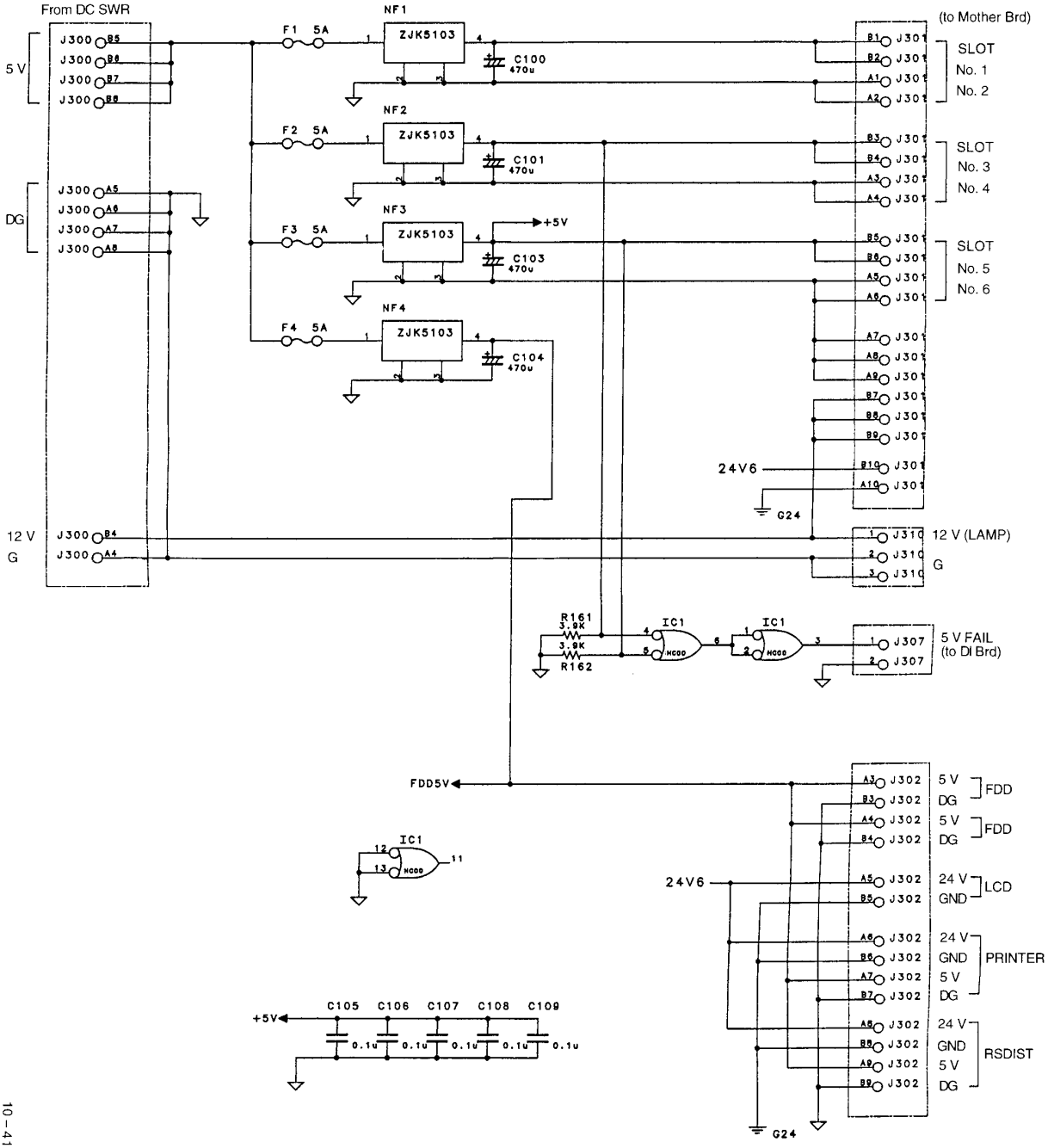




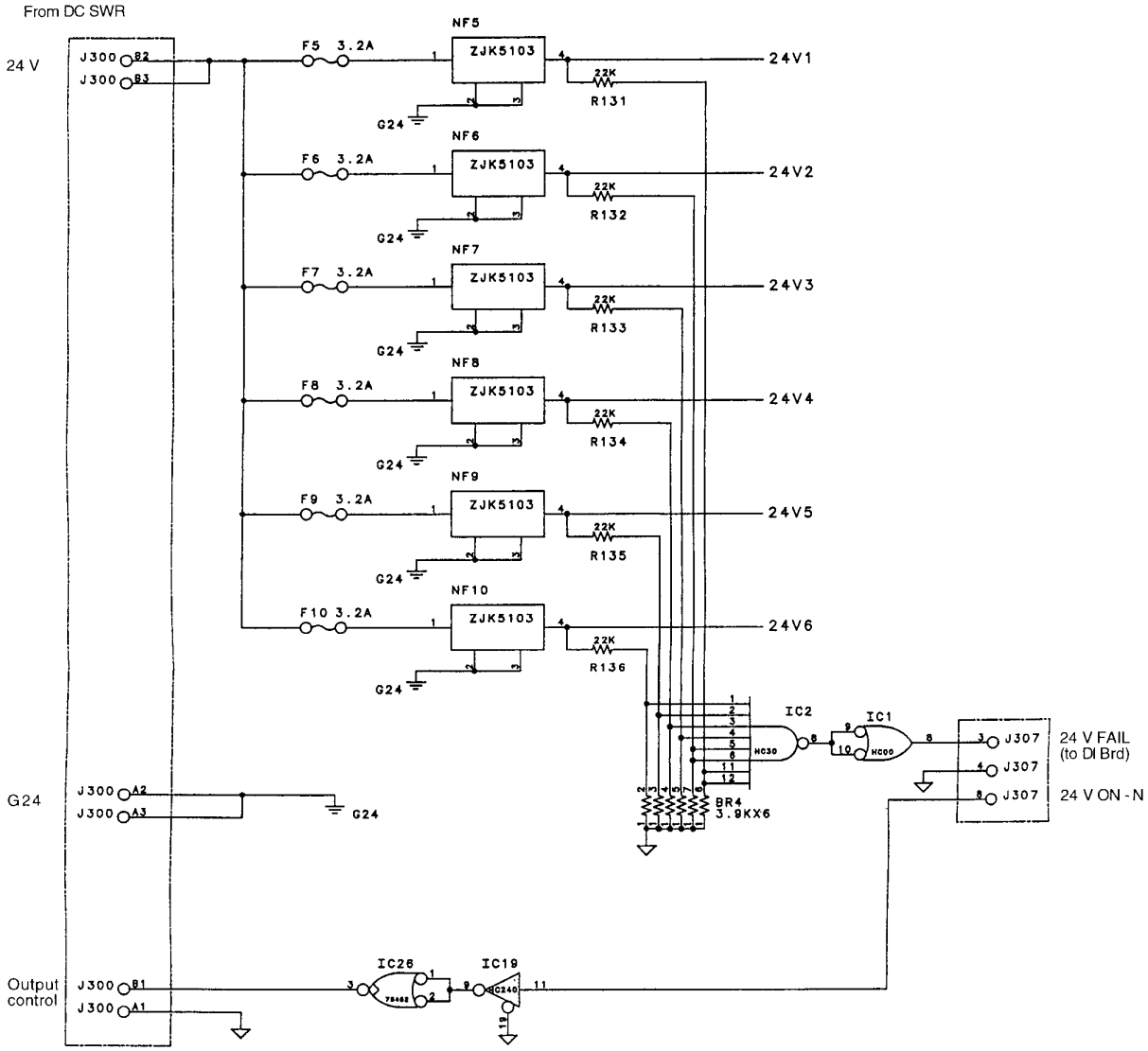
DRV Circuit 27135201 (8/10)



DRV Circuit 27135201 (9/10)



DRV Circuit 27135201 (10/10)

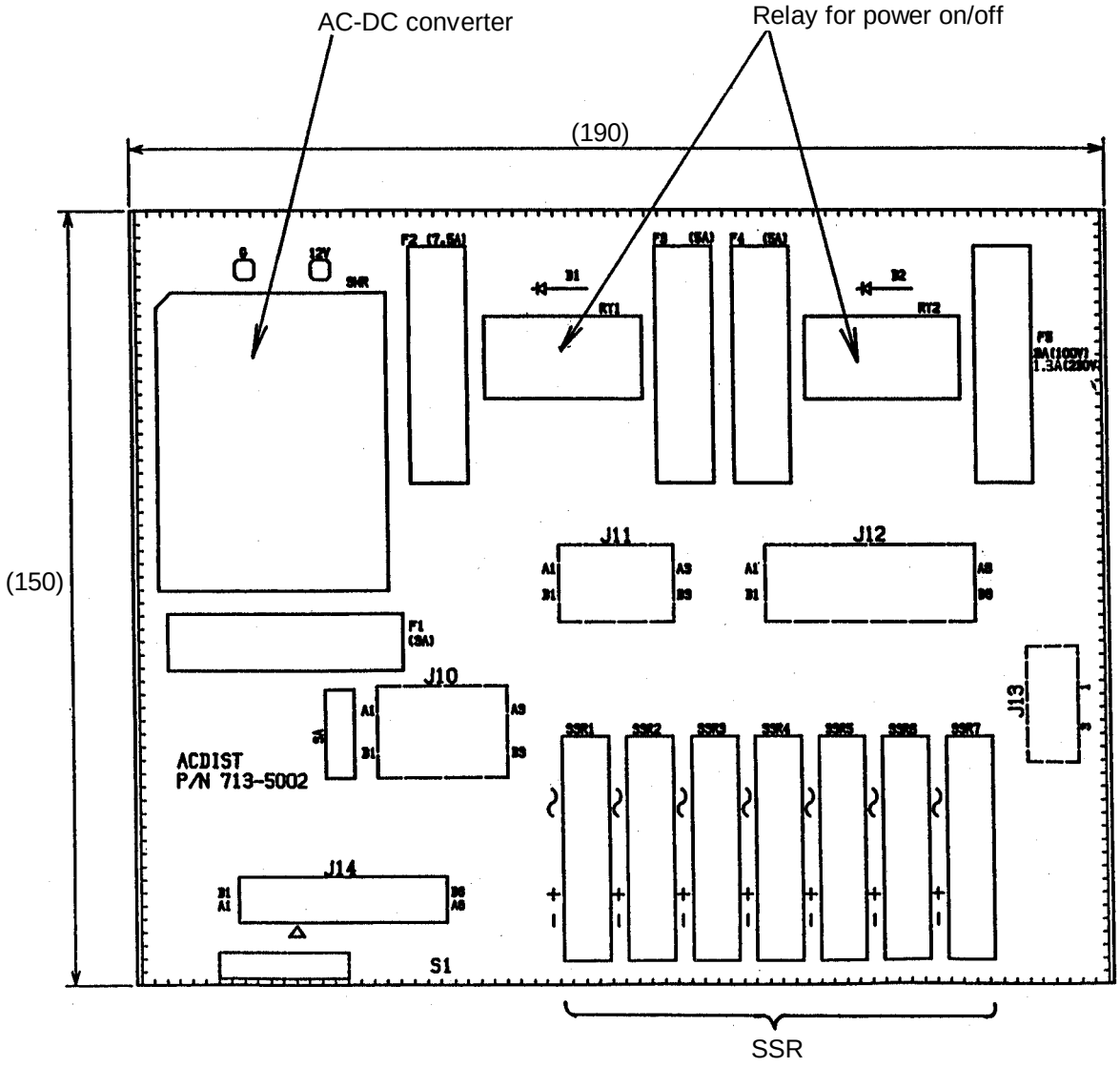


10.8 ACDIST Board (BM, BMC)

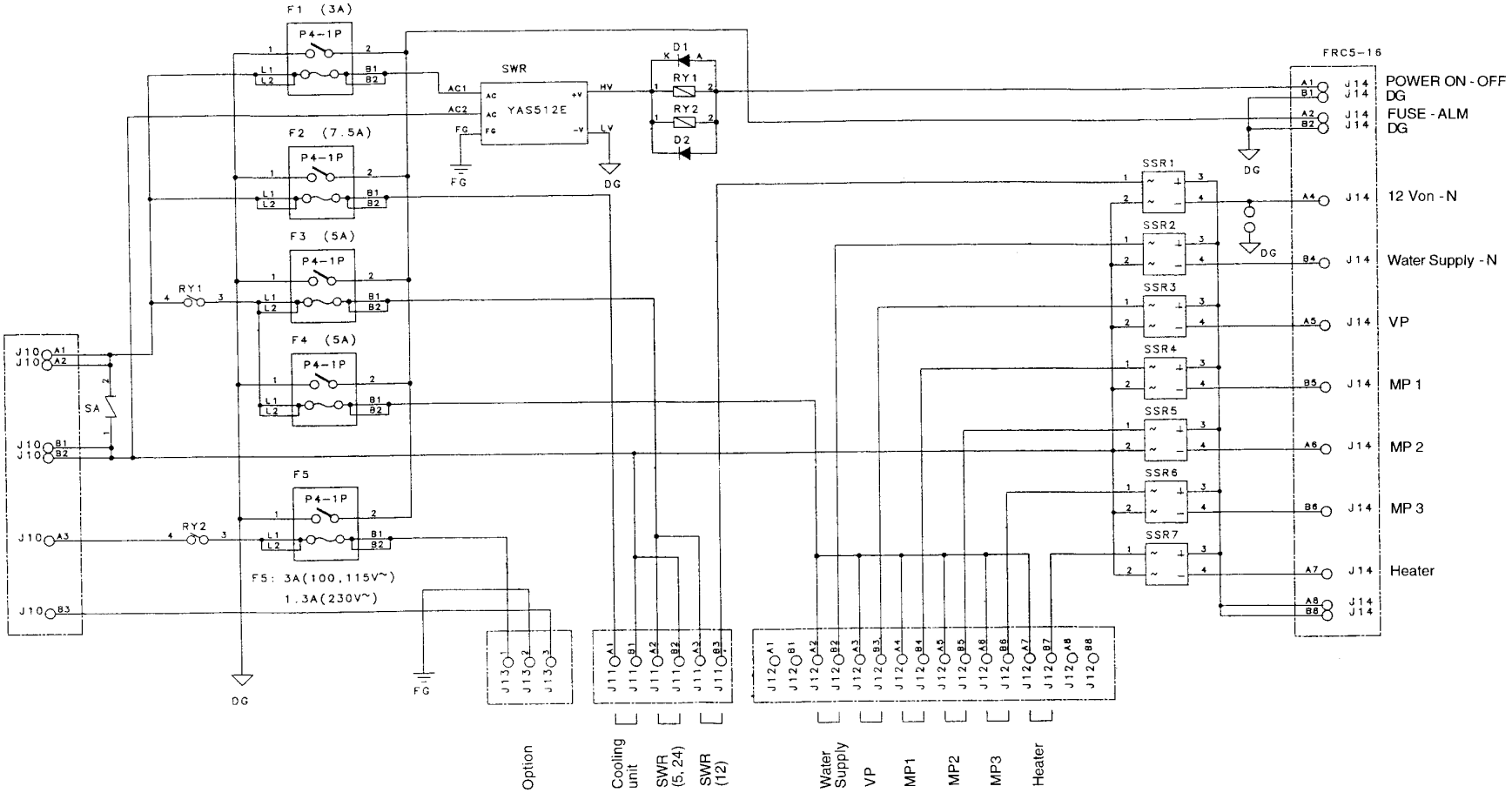
(1) Explanation of Circuit Board

This circuit board adapts the AC circuit part at the secondary side of the transformer and mounts alarm fuses and SSRs.
The board also mounts an AC-DC converter for relay operation because the relay on the board is used in place of the breaker for operation (turning on/off power supply to other than cooling unit) which was formerly arranged at the front of the instrument.

(2) External View



ACDIST Circuit Diagram

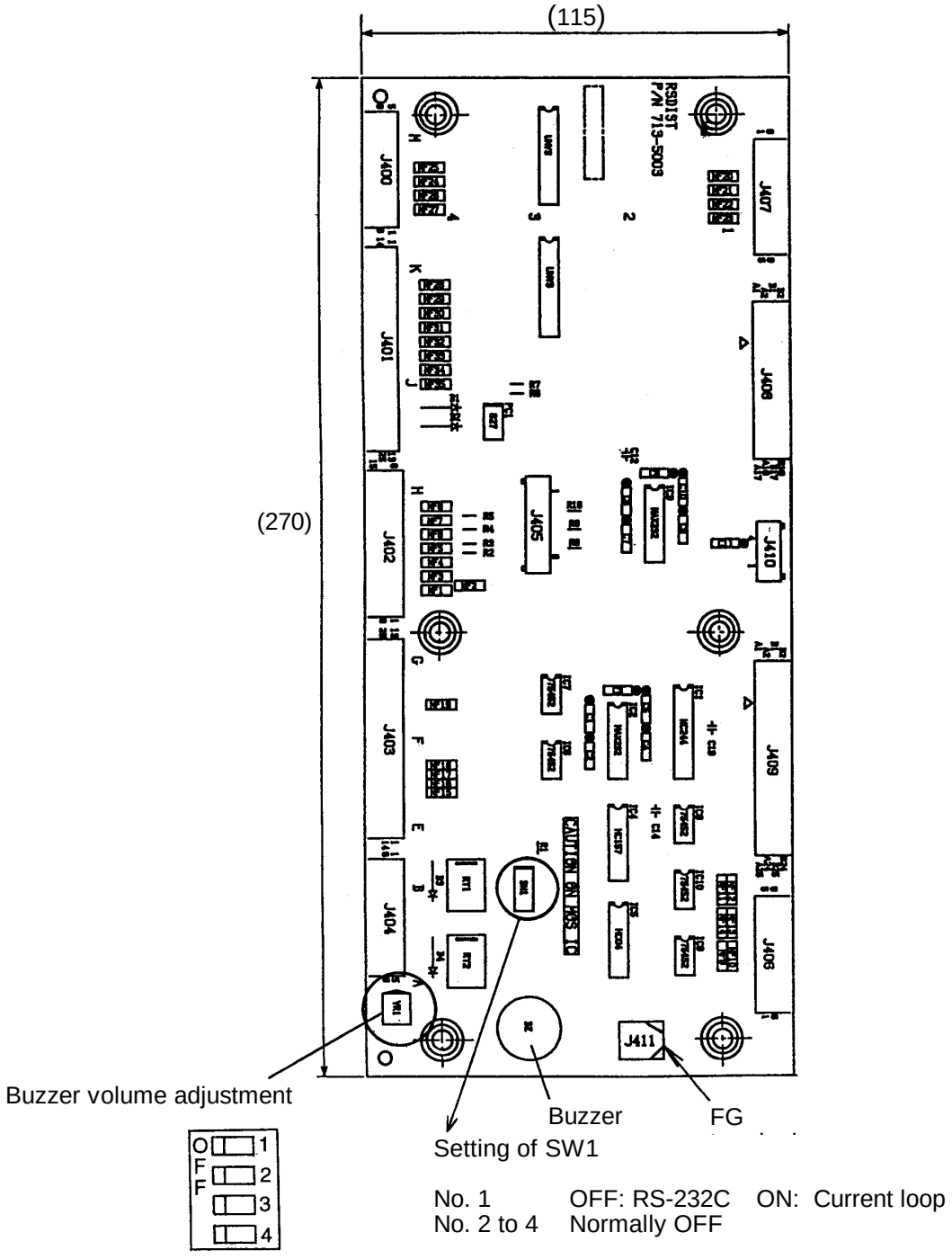


10.9 RSDIST Board

(1) Explanation of Circuit Board

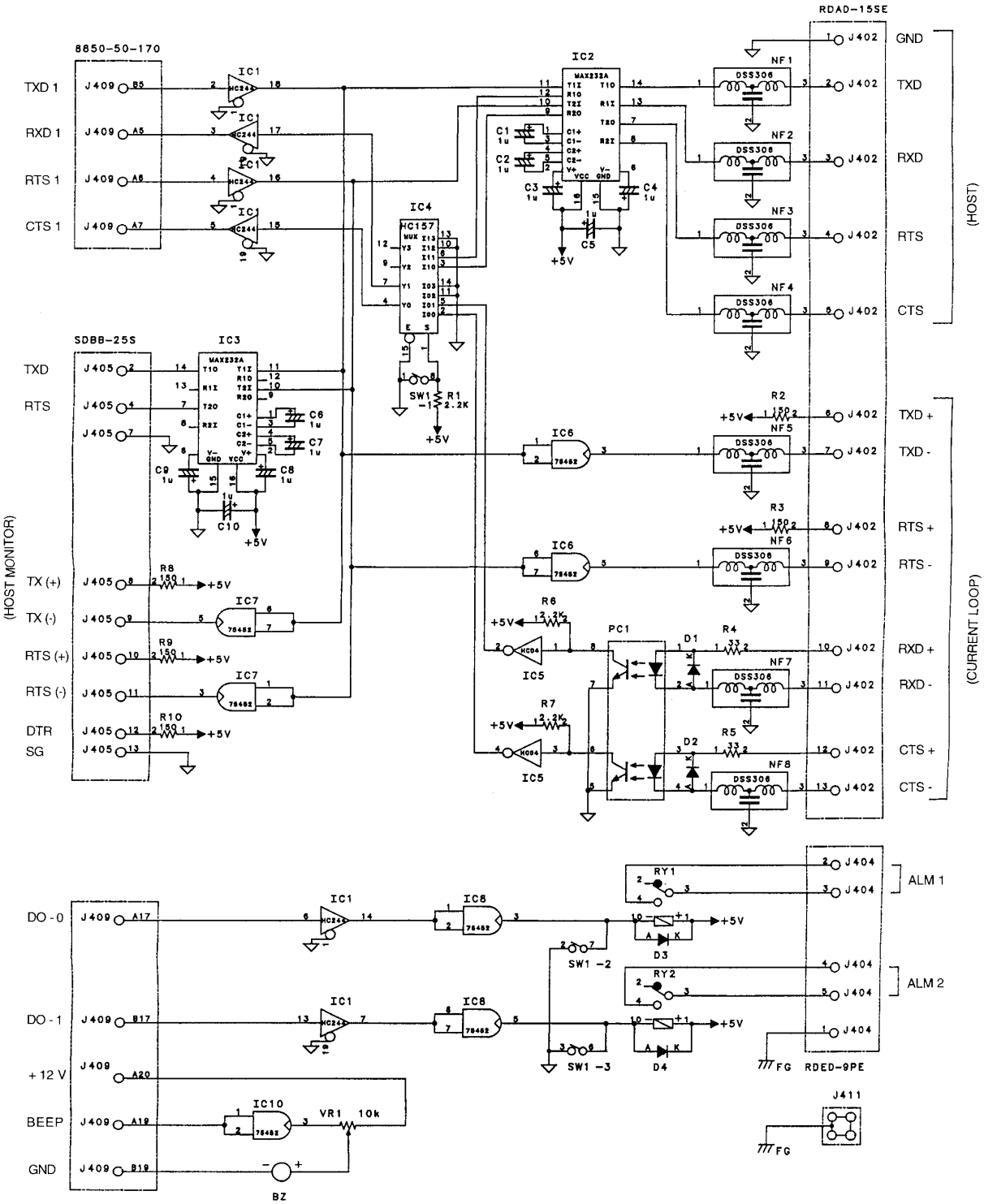
This circuit board interrupts/distributes RS-232C signals of the ECPU237 and EMIO100 boards. The board is provided with the current loop function for the host and permits changeover through DIP switch setting.
The board is also provided with an alarm buzzer, whose volume can be adjusted with VR1.

(2) External View

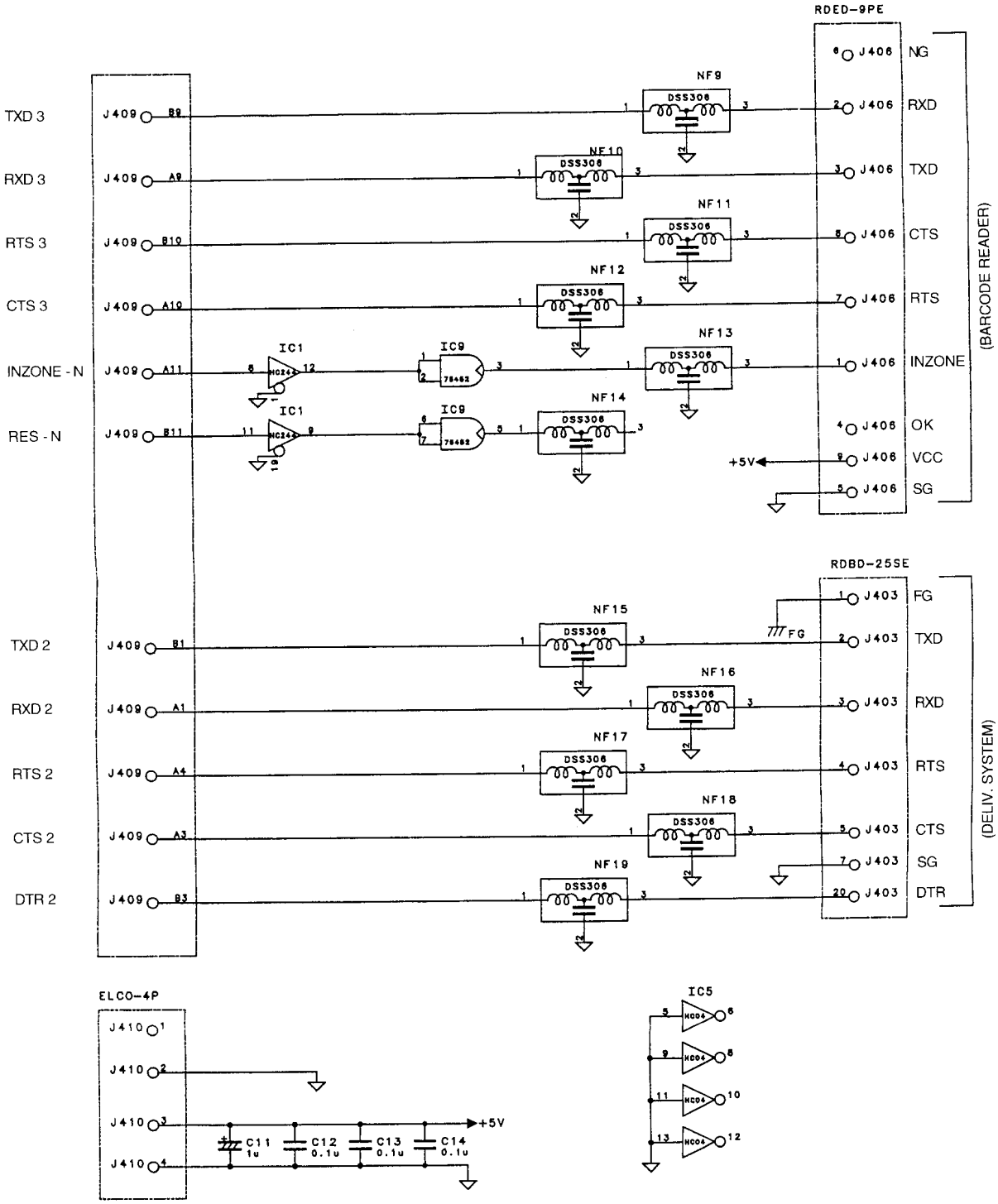


No. 1 OFF: RS-232C ON: Current loop
No. 2 to 4 Normally OFF

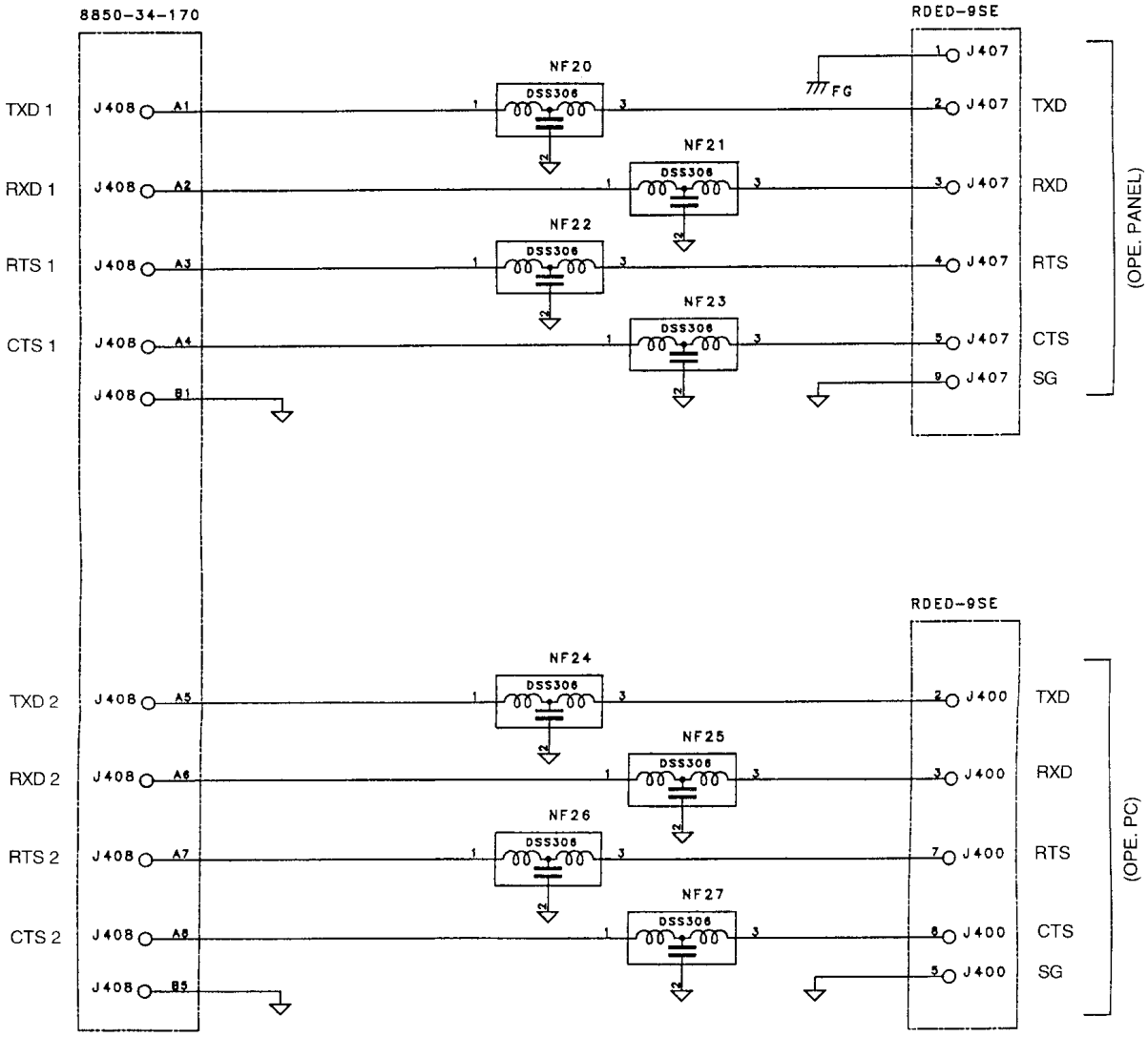
RSDIST Circuit 27135203 (1/4)



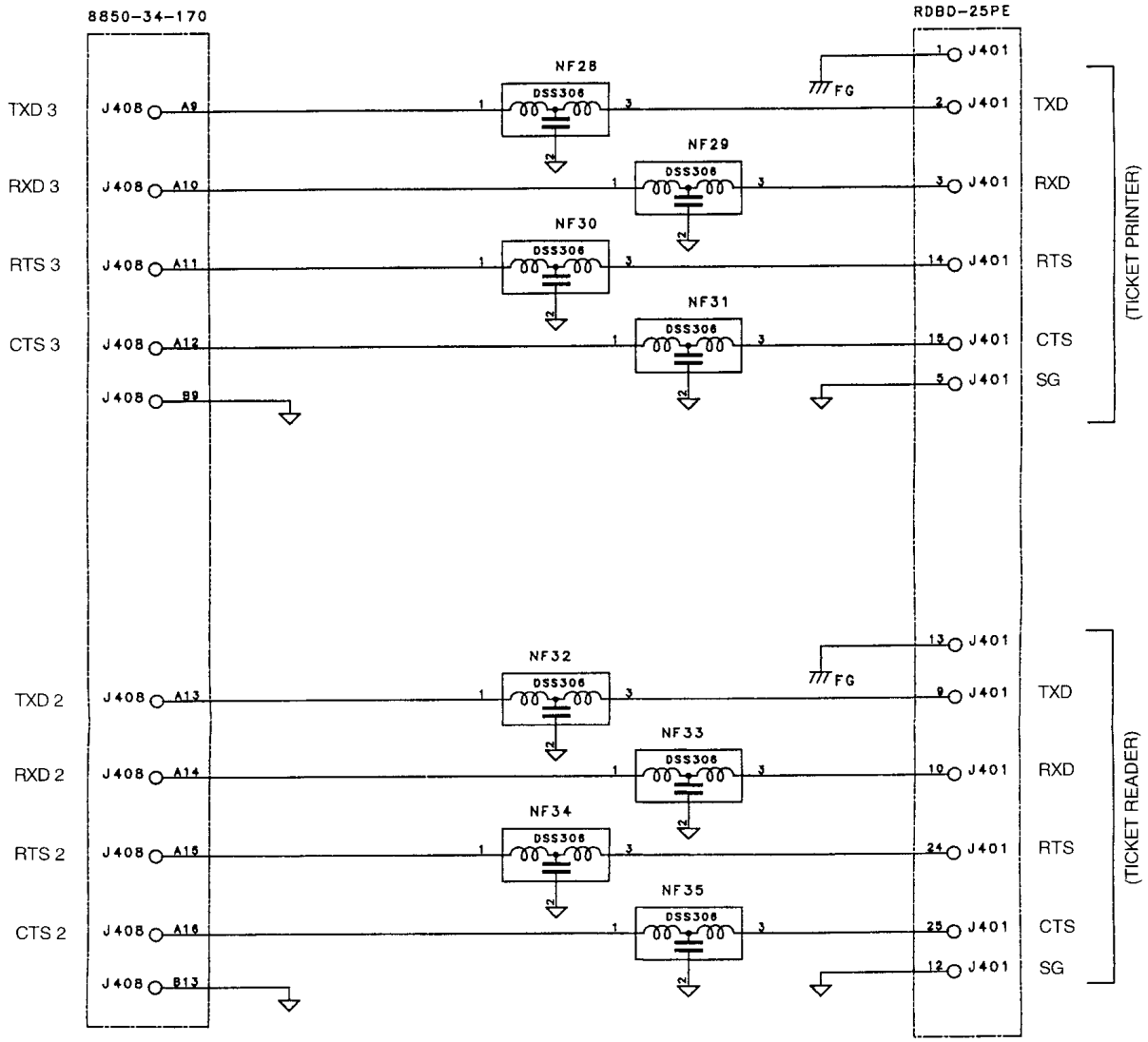
RSDIST Circuit 27135203 (2/4)



RSDIST Circuit 27135203 (3/4)



RSDIST Circuit 27135203 (4/4)

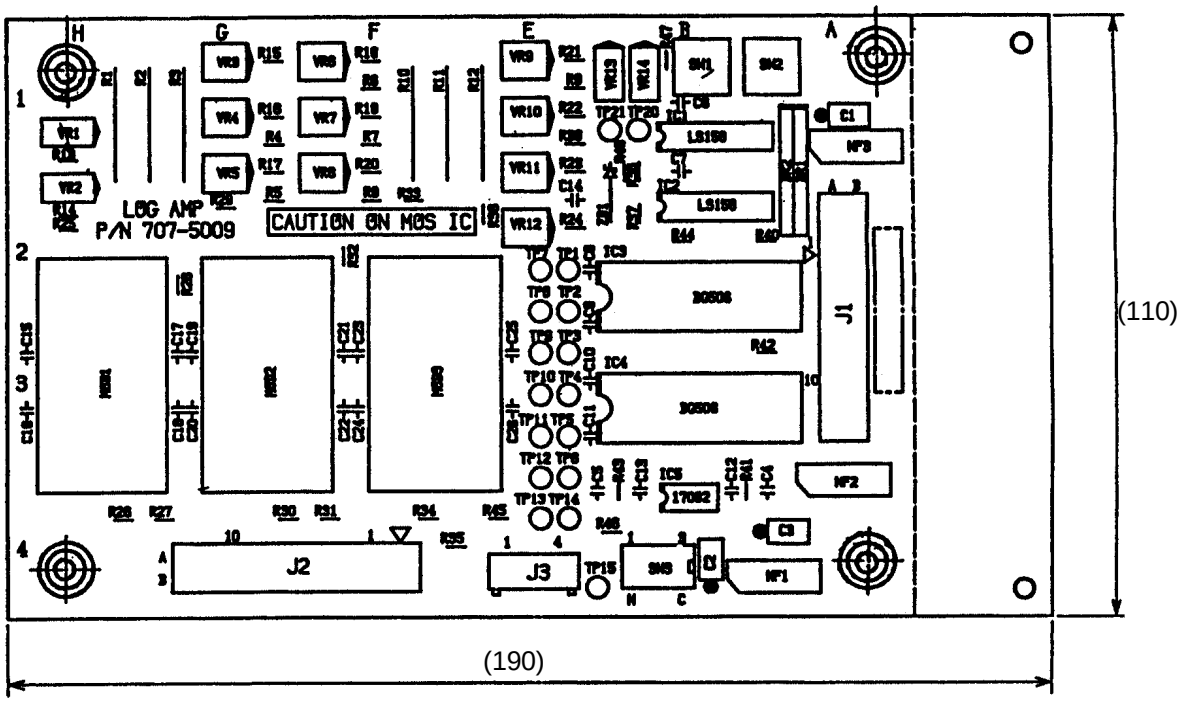


10.10 LOG AMP Board

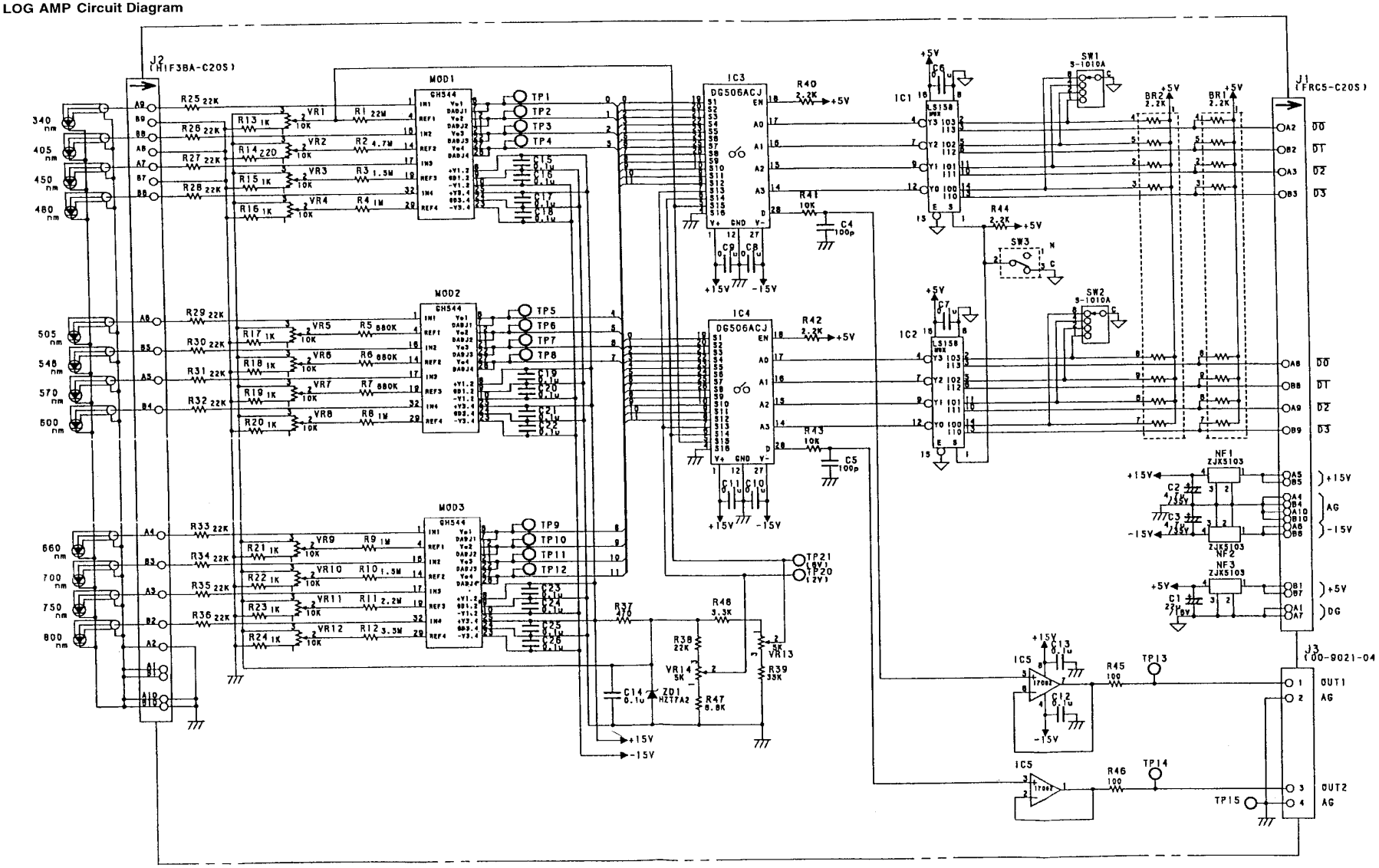
(1) Explanation of Circuit Board

This circuit board consists of a multiplexer, output buffer and 12-channel circuit for LOG conversion of photoelectric current from the detector.

(2) External View



LOG AMP Circuit Diagram

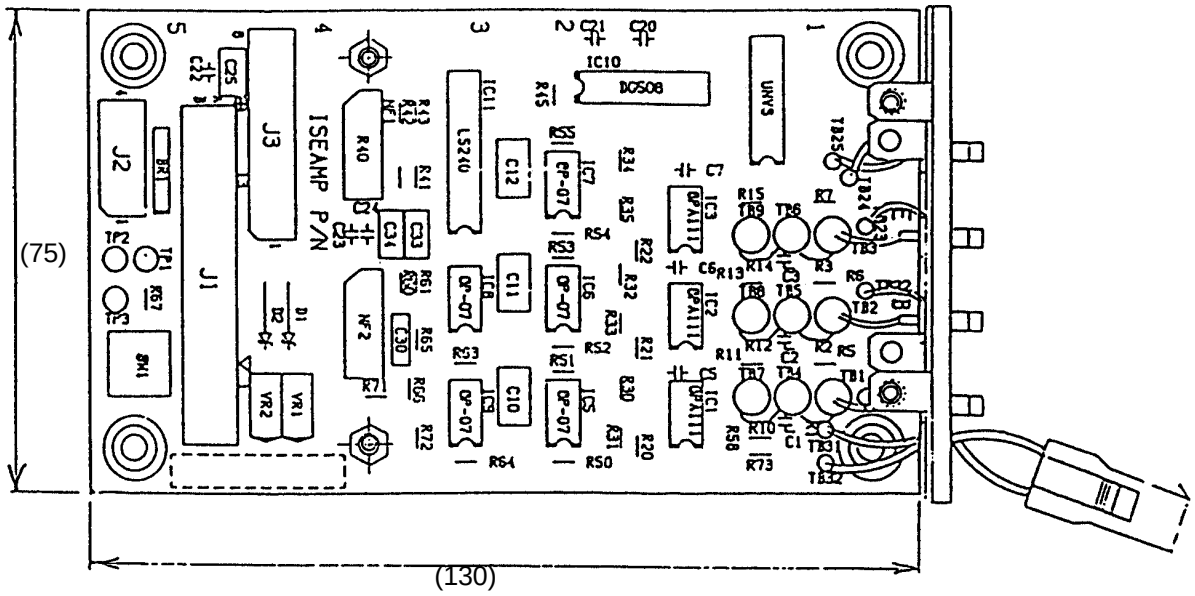


10.11 ISE AMP Board

(1) Explanation of Circuit Board

This amplifier is intended to amplify the ion selective electrode (ISE) signal. The input signal includes Na, K, Cl, Ref.

(2) External View



(3) ISE AMP Board Signal Address

Signal Name	ENa	EK	ECl	ERef	E2	E8
Multiplexer address	7	6	5	4	3	2
SW1 address	7	6	5	4	3	2

< Confirmation of ISE AMP Voltage >

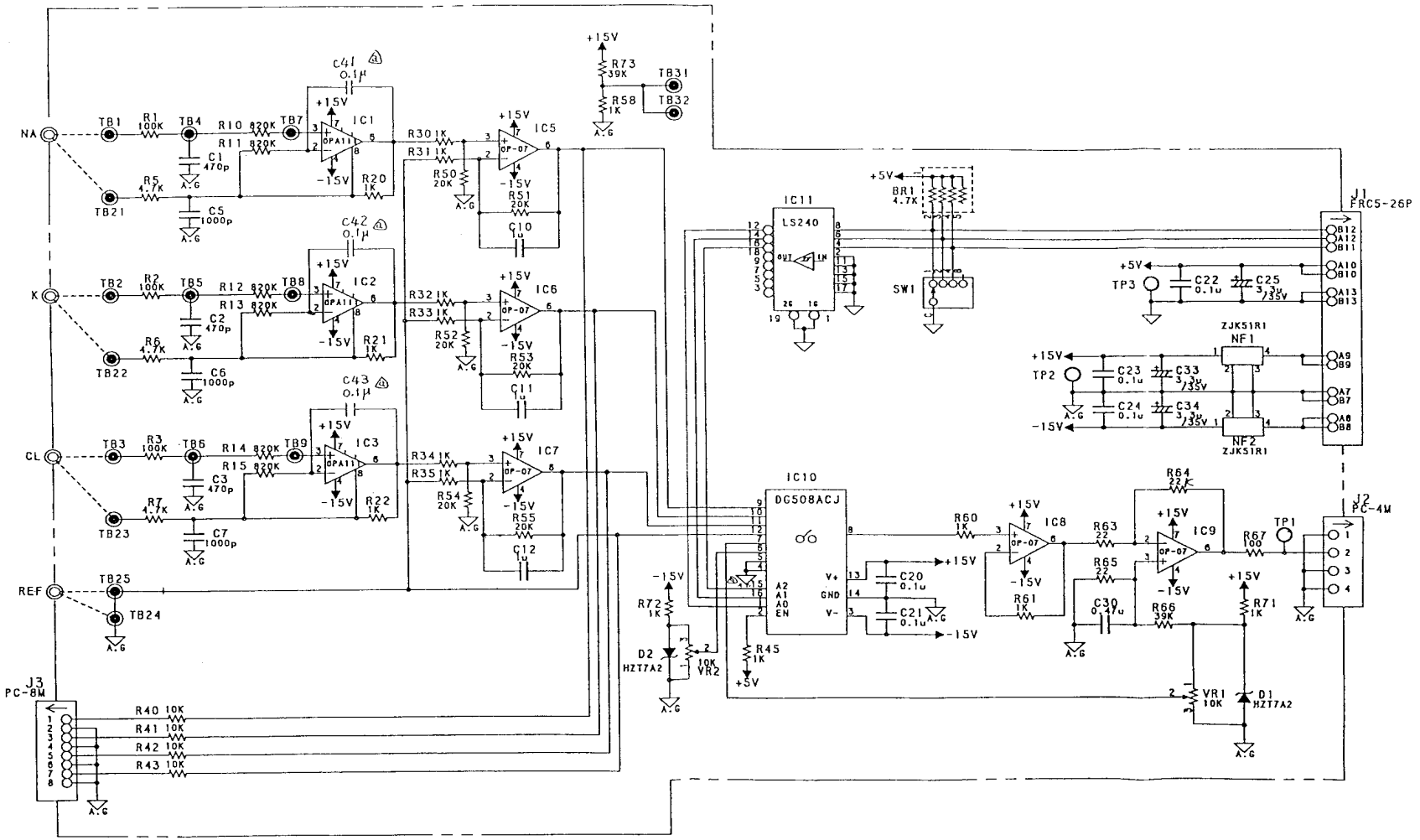
Confirm the voltage between TP1 and TP2.

(a) Select ERef (SW no. 4) with the multiplexer and confirm that the output is 4.69 < ERef < 5.05.

(b) Select E2 (SW no. 3) with the multiplexer and confirm that the output is 2.00 ± 0.005 V. [adjustment of VR1]

(c) Select E8 (SW no. 2) with the multiplexer and confirm that the output is 8.00 ± 0.005 V. [adjustment of VR2]

(4) ISE AMP circuit diagram

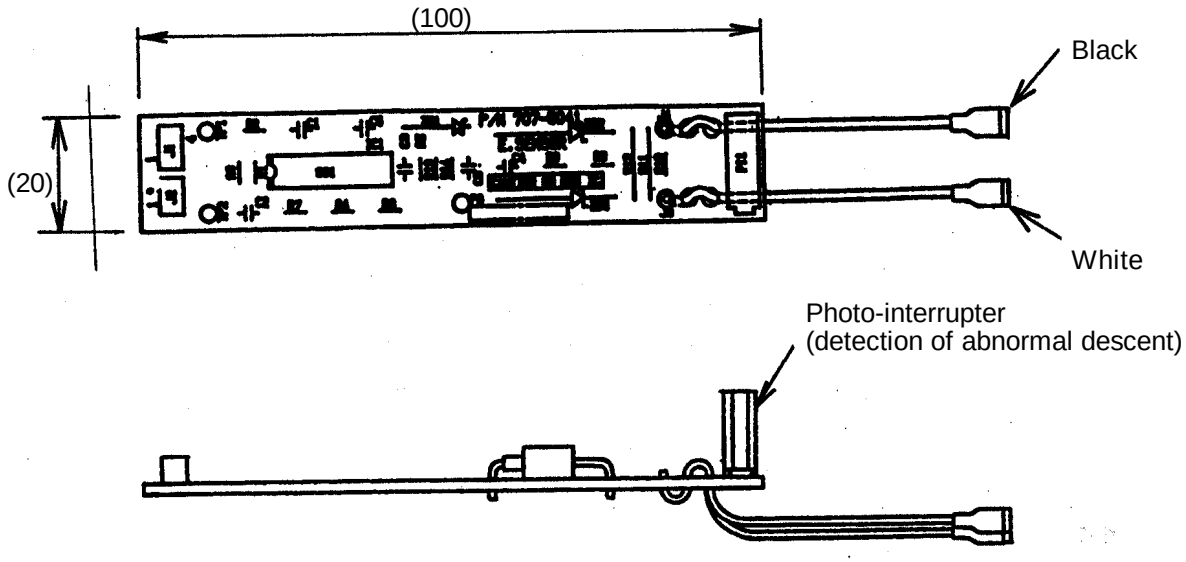


10.12 E. SENSOR Board

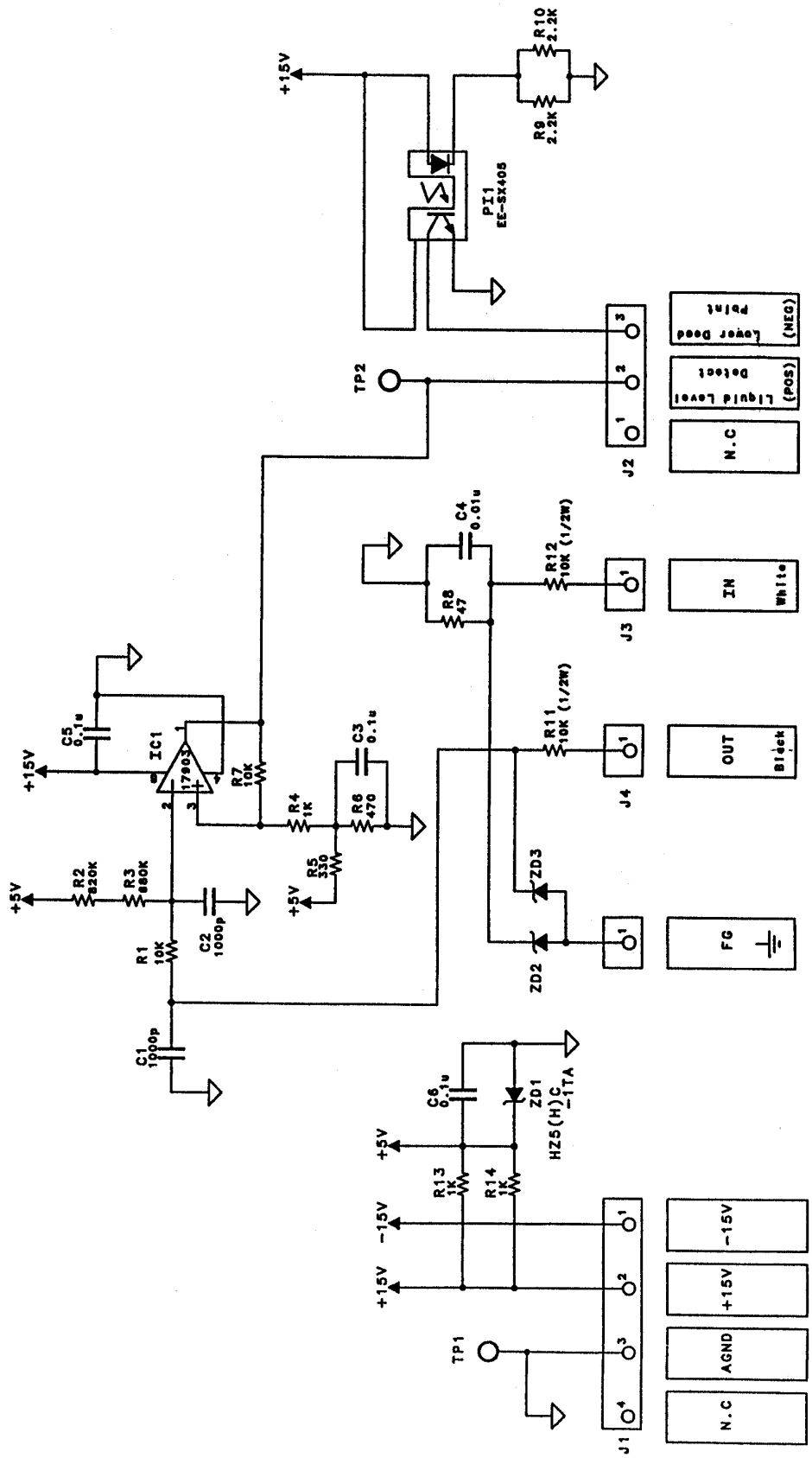
(1) Explanation of Circuit Board

This circuit board is a resistor type liquid level sensor which is incorporated in the sampling arm.

(2) External View



E. SENSOR Circuit Diagram

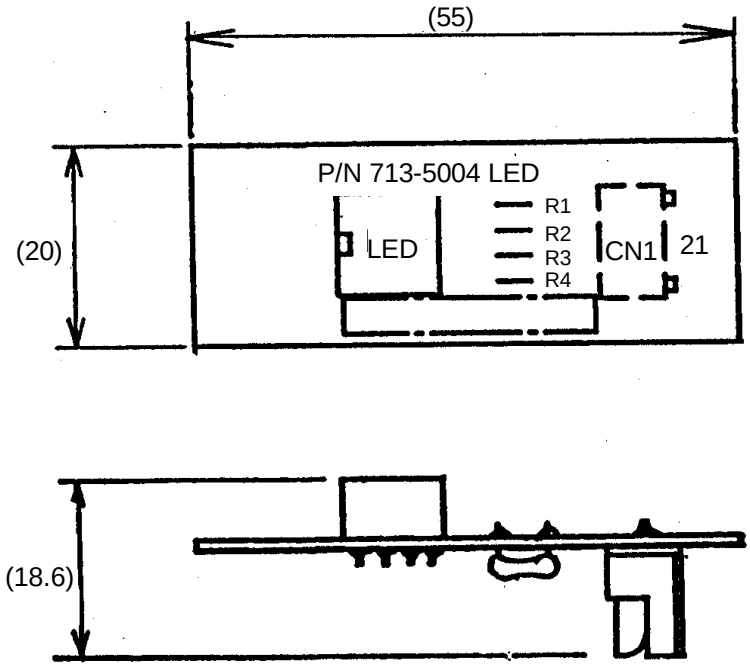


10.13 LED Board

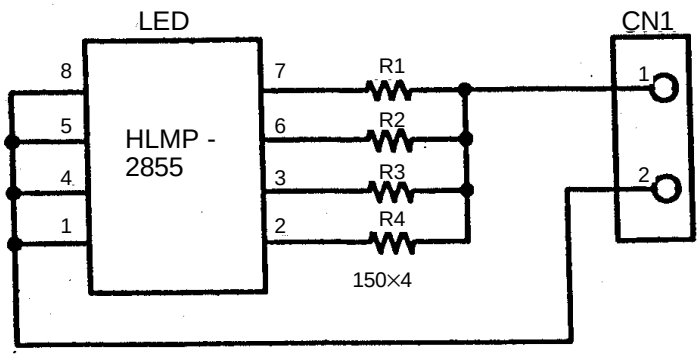
(1) Explanation of Circuit Board

This circuit board is for alarm indication before S. disk rotation.

(2) External View



(3) LED Circuit Diagram



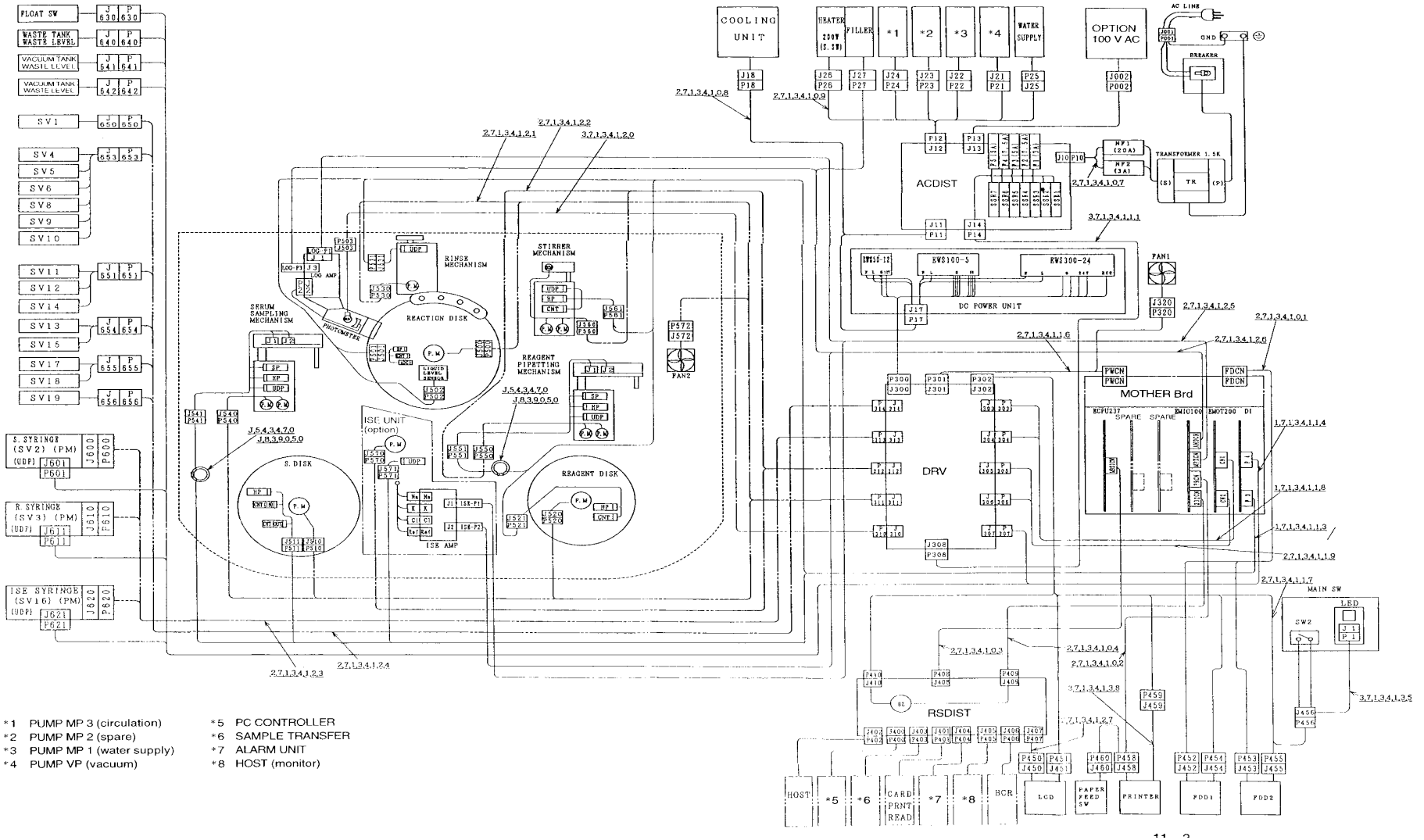
11. CROSS WIRING REFERENC

11.1 Overall Wiring Diagramm 11-2

11.2 Cross Wiring Reference 11-3

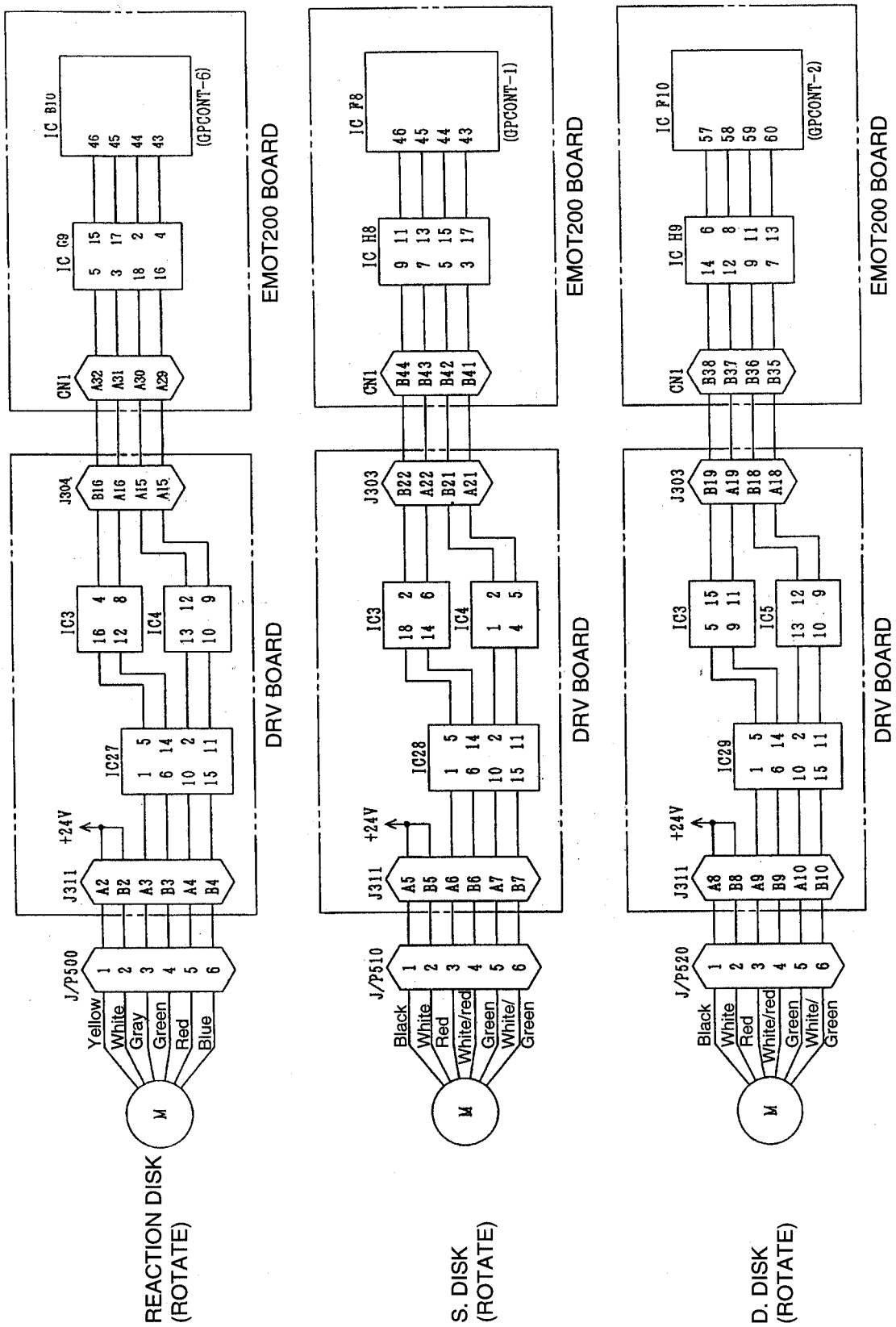
11. CROSS WIRING REFERENCE

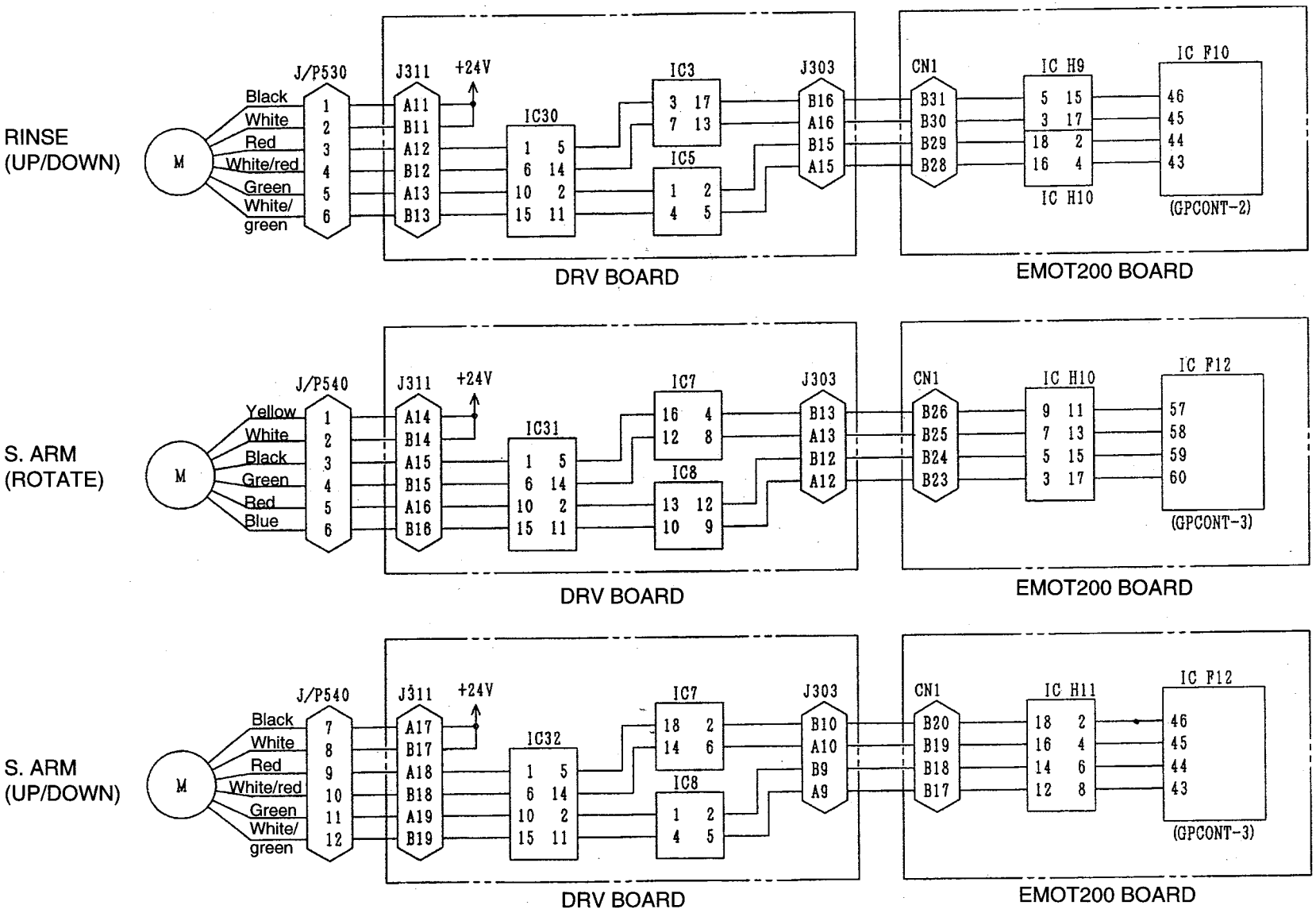
11.1 Overall Wiring Diagram



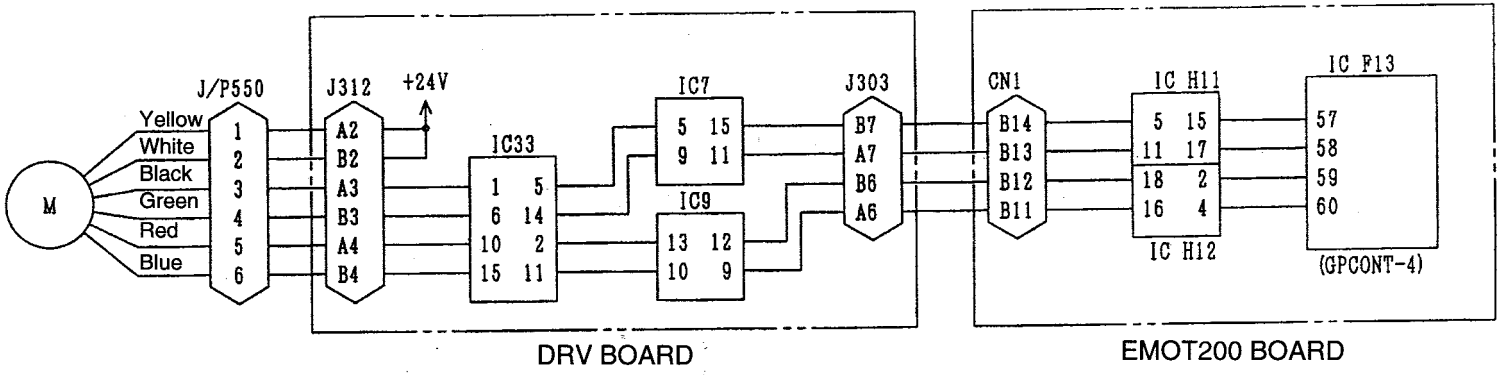
*1 PUMP MP 3 (circulation)
*2 PUMP MP 2 (spare)
*3 PUMP MP 1 (water supply)
*4 PUMP VP (vacuum)
*5 PC CONTROLLER
*6 SAMPLE TRANSFER
*7 ALARM UNIT
*8 HOST (monitor)

11.2 Cross Wiring Reference

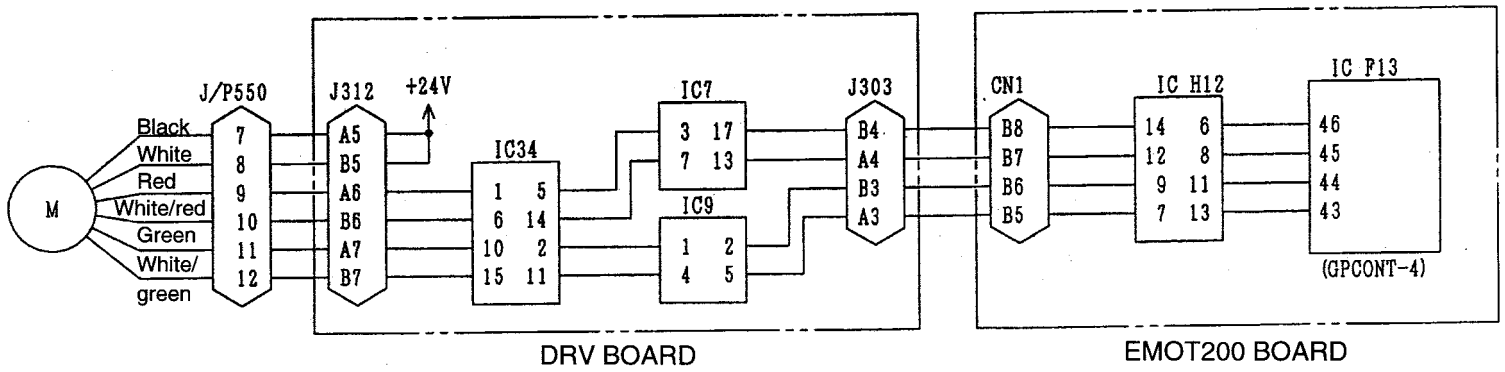



RINSE
(UP/DOWN)
M
Black
White
Red
White/red
Green
White/
green
J/P530
1
2
3
4
5
6
J311
A11
B11
A12
B12
A13
B13
+24V
IC30
1 5
6 14
10 2
15 11
IC3
3 17
7 13
IC5
1 2
4 5
J303
B16
A16
B15
A15
DRV BOARD
CN1
B31
B30
B29
B28
IC H9
5 15
3 17
18 2
16 4
IC H10
IC F10
46
45
44
43
(GPCONT-2)
EMOT200 BOARD
S. ARM
(ROTATE)
M
Yellow
White
Black
Green
Red
Blue
J/P540
1
2
3
4
5
6
J311
A14
B14
A15
B15
A16
B16
+24V
IC31
1 5
6 14
10 2
15 11
IC7
16 4
12 8
IC8
13 12
10 9
J303
B13
A13
B12
A12
DRV BOARD
CN1
B26
B25
B24
B23
IC H10
9 11
7 13
5 15
3 17
IC F12
57
58
59
60
(GPCONT-3)
EMOT200 BOARD
S. ARM
(UP/DOWN)
M
Black
White
Red
White/red
Green
White/
green
J/P540
7
8
9
10
11
12
J311
A17
B17
A18
B18
A19
B19
+24V
IC32
1 5
6 14
10 2
15 11
IC7
18 2
14 6
IC8
1 2
4 5
J303
B10
A10
B9
A9
DRV BOARD
CN1
B20
B19
B18
B17
IC H11
18 2
16 4
14 6
12 8
IC F12
46
45
44
43
(GPCONT-3)
EMOT200 BOARD

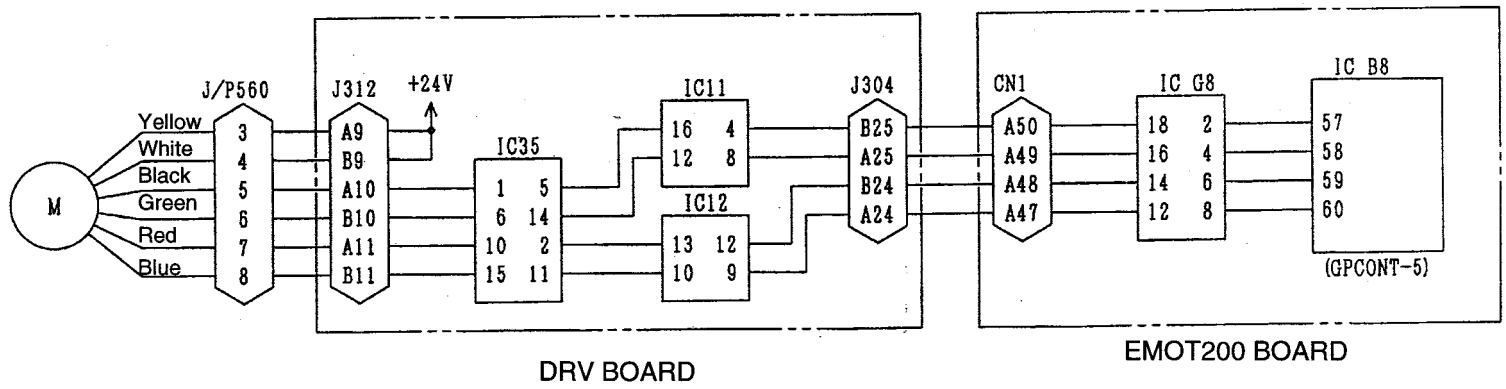
R. ARM
(ROTATE)



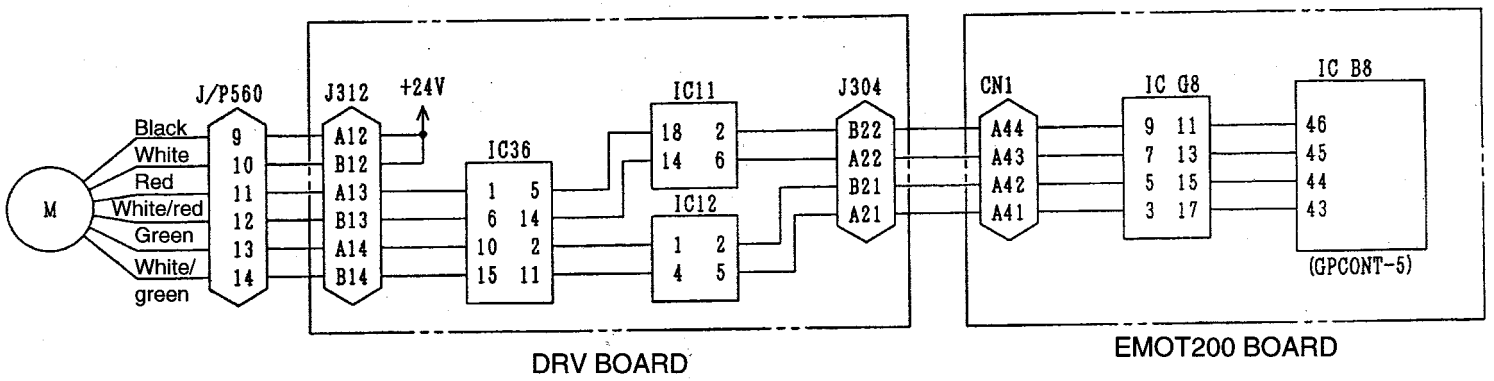
R. ARM
(UP/DOWN)



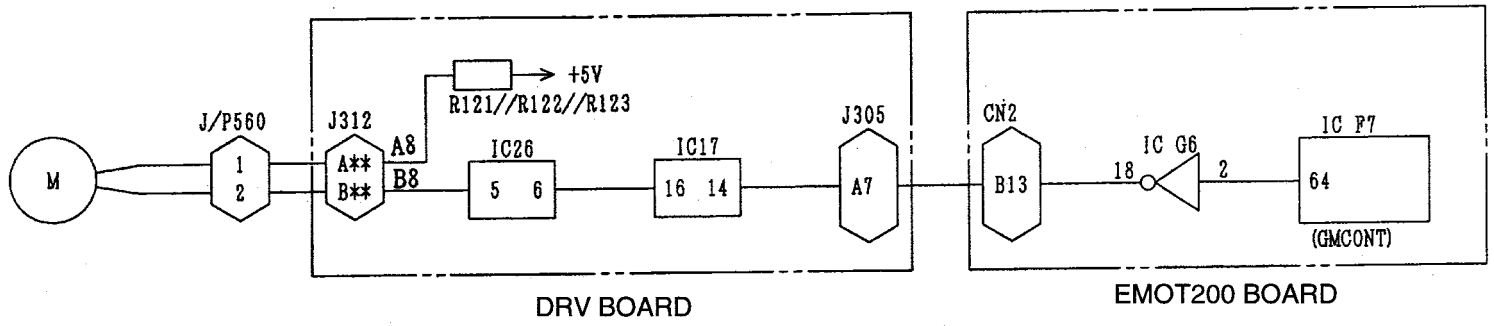
STIRRER
ARM
(ROTATE)

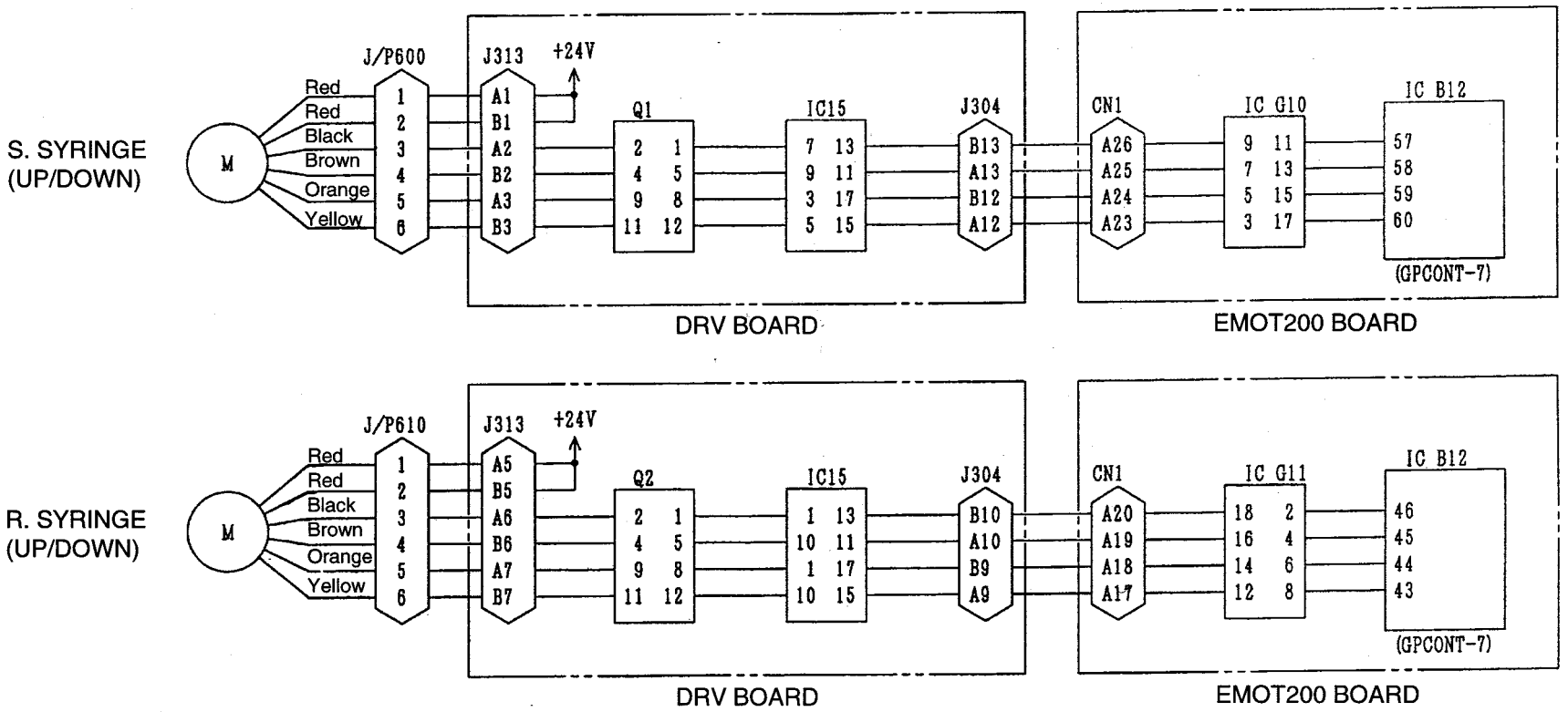


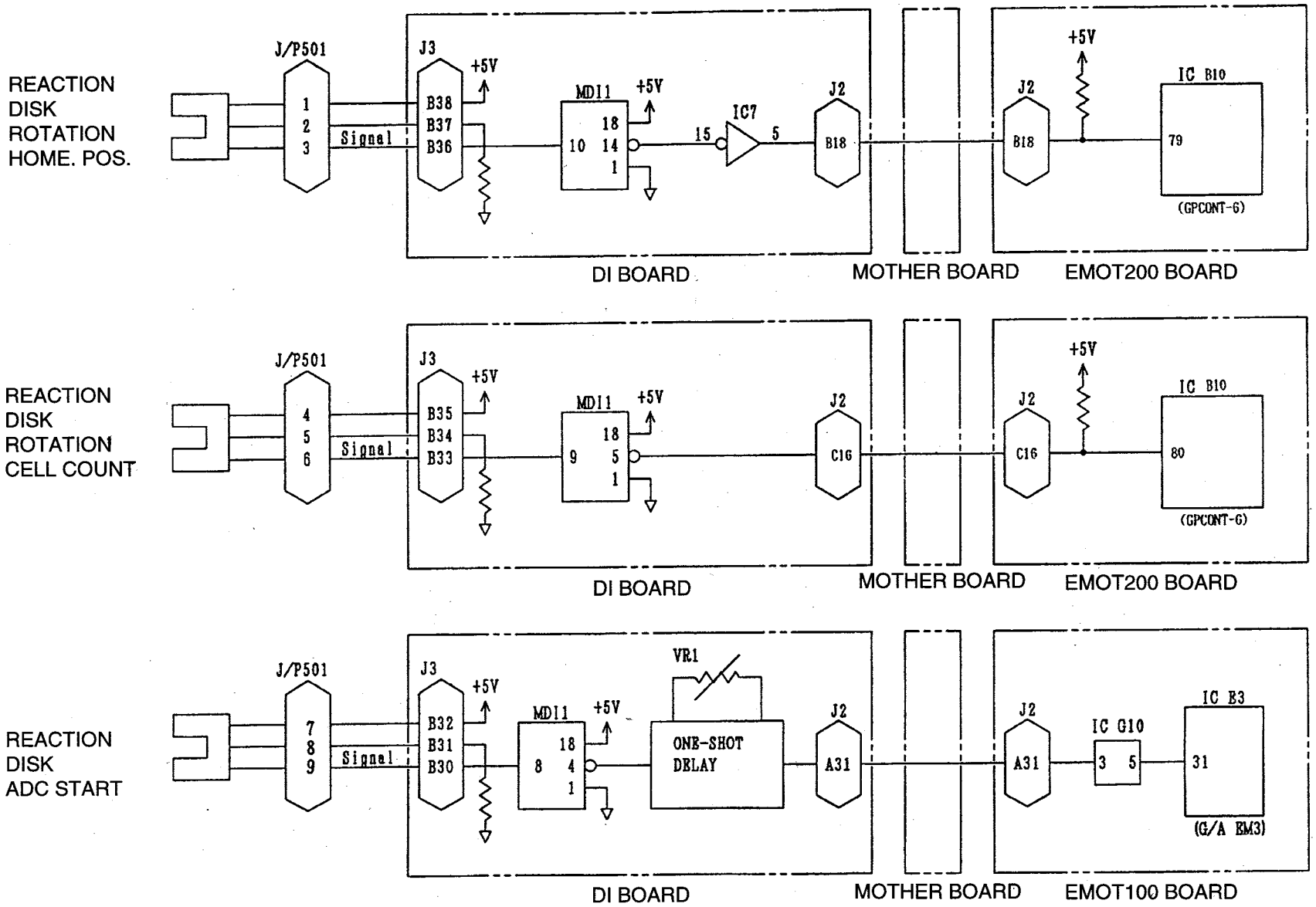
STIRRER
ARM
(UP/DOWN)



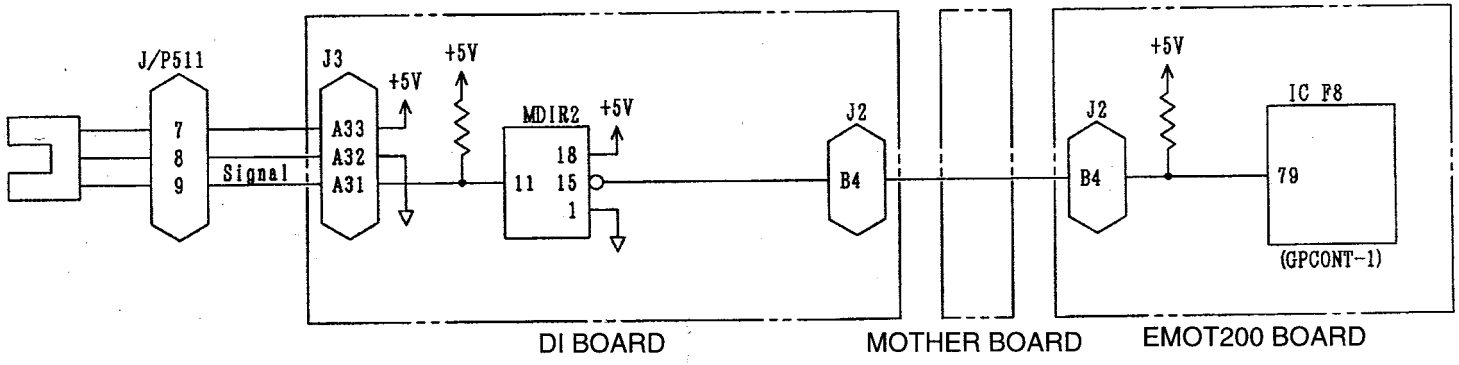
STIRRER
ROD
(ROTATE)



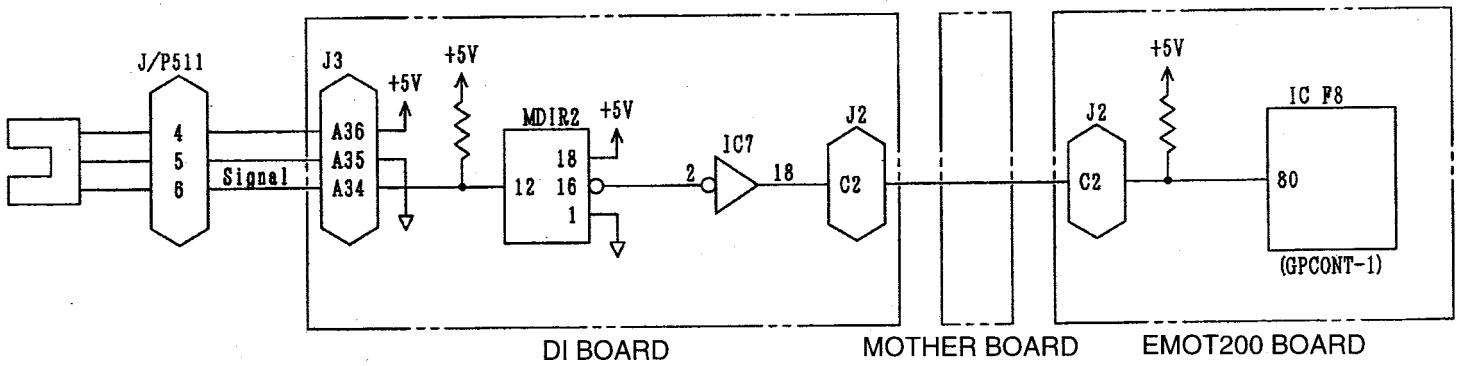

S. SYRINGE
(UP/DOWN)
M
Red
Red
Black
Brown
Orange
Yellow
J/P600
1
2
3
4
5
6
J313
+24V
A1
B1
A2
B2
A3
B3
Q1
2 1
4 5
9 8
11 12
IC15
7 13
9 11
3 17
5 15
J304
B13
A13
B12
A12
DRV BOARD
CN1
A26
A25
A24
A23
IC G10
9 11
7 13
5 15
3 17
IC B12
57
58
59
60
(GPCONT-7)
EMOT200 BOARD
R. SYRINGE
(UP/DOWN)
M
Red
Red
Black
Brown
Orange
Yellow
J/P610
1
2
3
4
5
6
J313
+24V
A5
B5
A6
B6
A7
B7
Q2
2 1
4 5
9 8
11 12
IC15
1 13
10 11
1 17
10 15
J304
B10
A10
B9
A9
DRV BOARD
CN1
A20
A19
A18
A17
IC G11
18 2
16 4
14 6
12 8
IC B12
46
45
44
43
(GPCONT-7)
EMOT200 BOARD


REACTION
DISK
ROTATION
HOME. POS.
J/P501
1
2
3
Signal
J3
B38
B37
B36
+5V
MD11
18
10
14
1
+5V
IC7
15
5
J2
B18
DI BOARD
MOTHER BOARD
+5V
J2
B18
IC B10
79
(GPCONT-6)
EMOT200 BOARD
REACTION
DISK
ROTATION
CELL COUNT
J/P501
4
5
6
Signal
J3
B35
B34
B33
+5V
MD11
18
9
5
1
+5V
J2
C16
DI BOARD
MOTHER BOARD
+5V
J2
C16
IC B10
80
(GPCONT-6)
EMOT200 BOARD
REACTION
DISK
ADC START
J/P501
7
8
9
Signal
J3
B32
B31
B30
+5V
MD11
18
8
4
1
+5V
VR1
ONE-SHOT
DELAY
J2
A31
DI BOARD
MOTHER BOARD
J2
A31
IC G10
3
5
IC E3
31
(G/A EM3)
EMOT100 BOARD

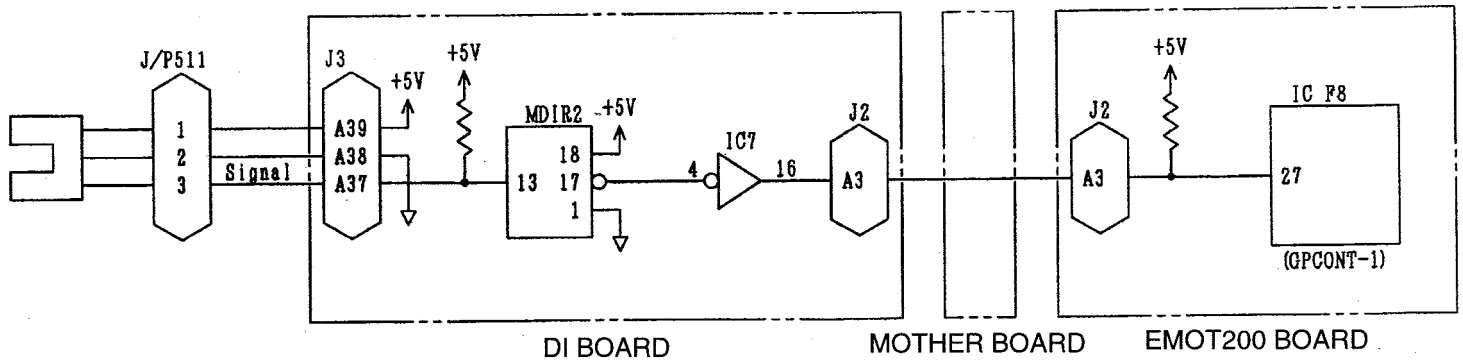
REACTION
S. DISK
ROTATION
HOME POS.



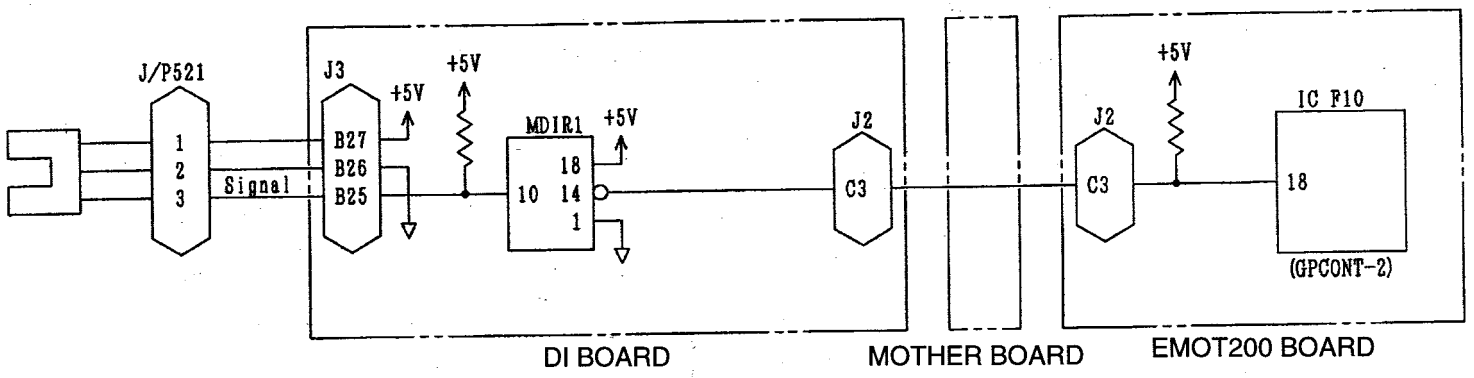
S. DISK
ROTATION
INSIDE
COUNT



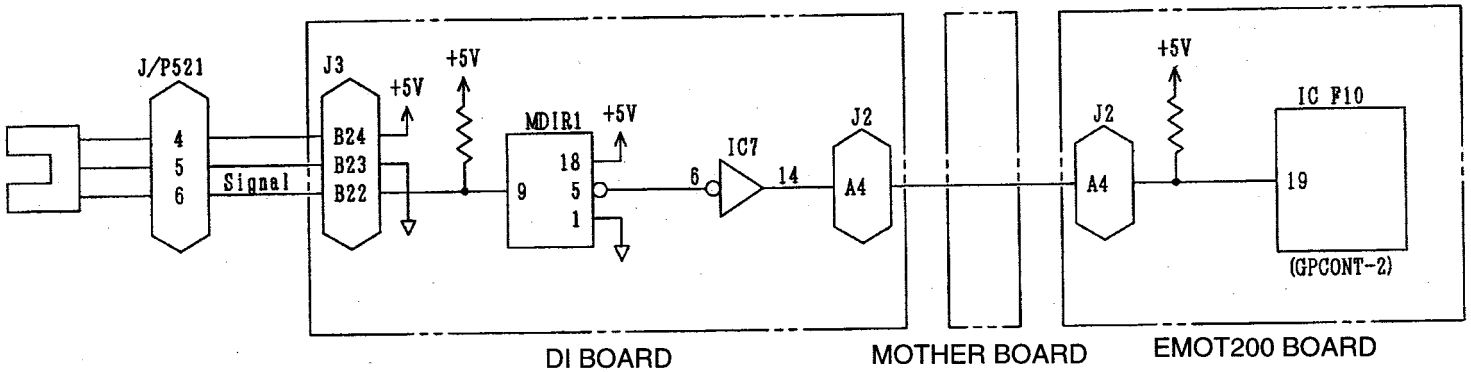
S. DISK
ROTATION
OUTSIDE
COUNT



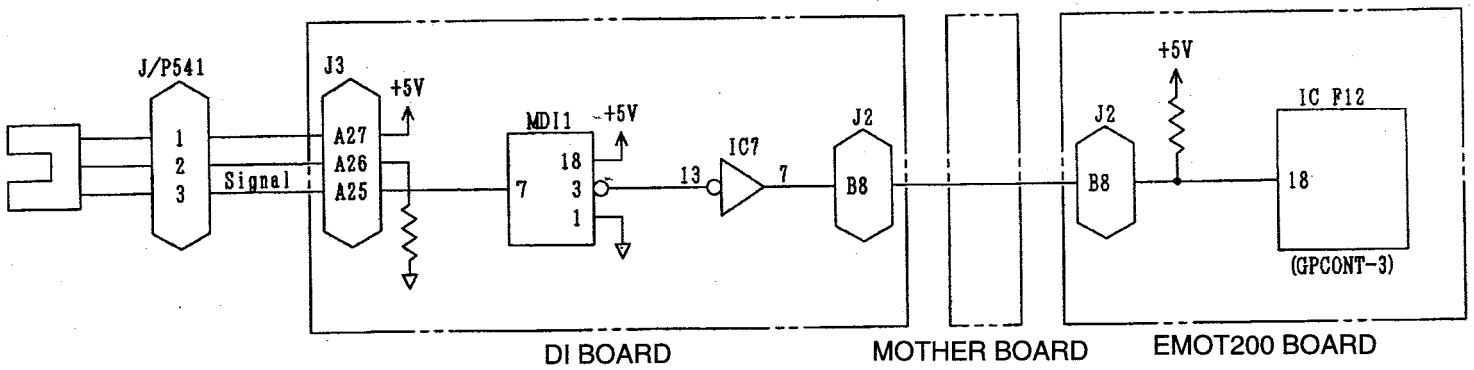
R. DISK
ROTATION
HOME POS.



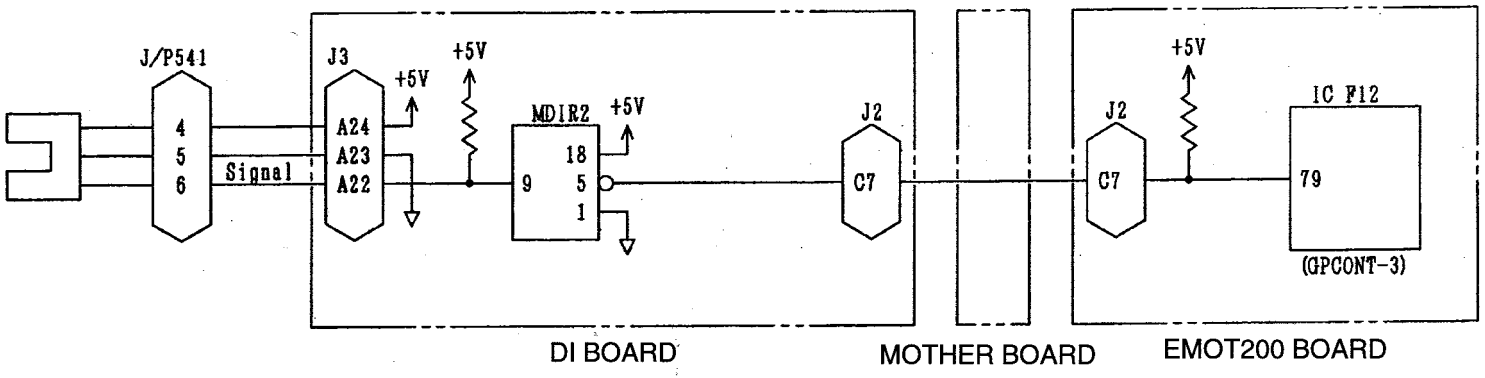
R. DISK
ROTATION
COUNT



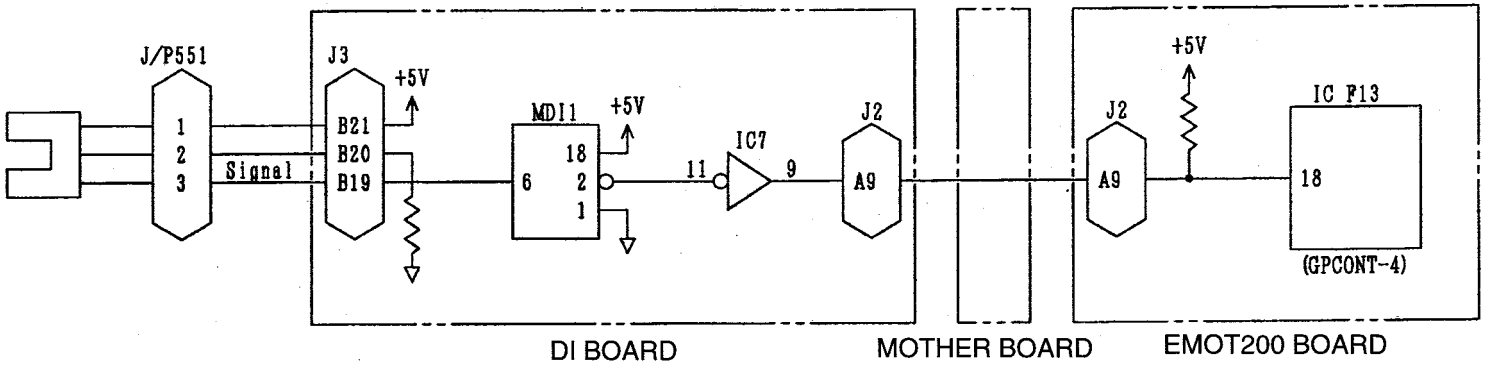
S. ARM
ROTATION
HOME POS.



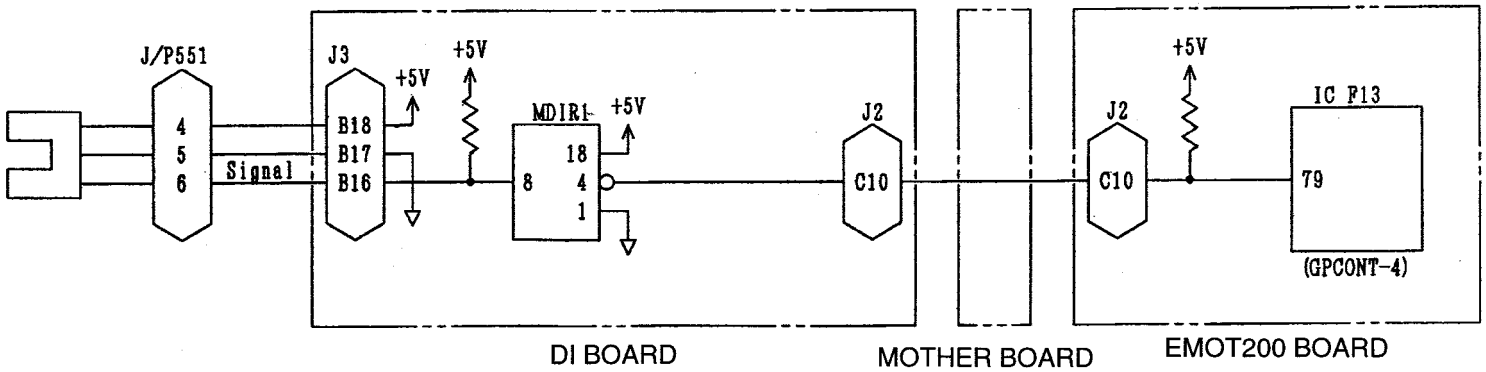
S. ARM
U. D. P.

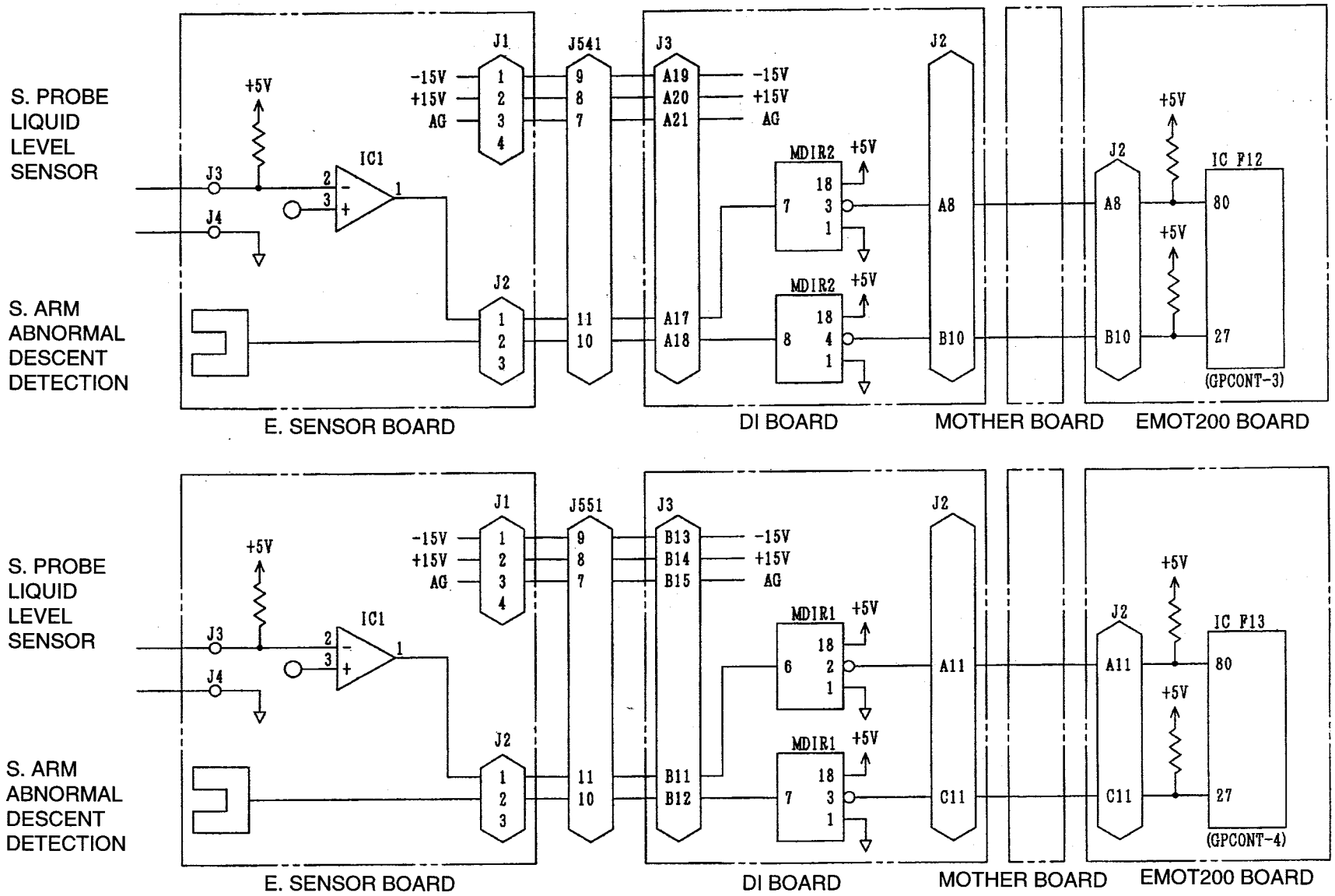


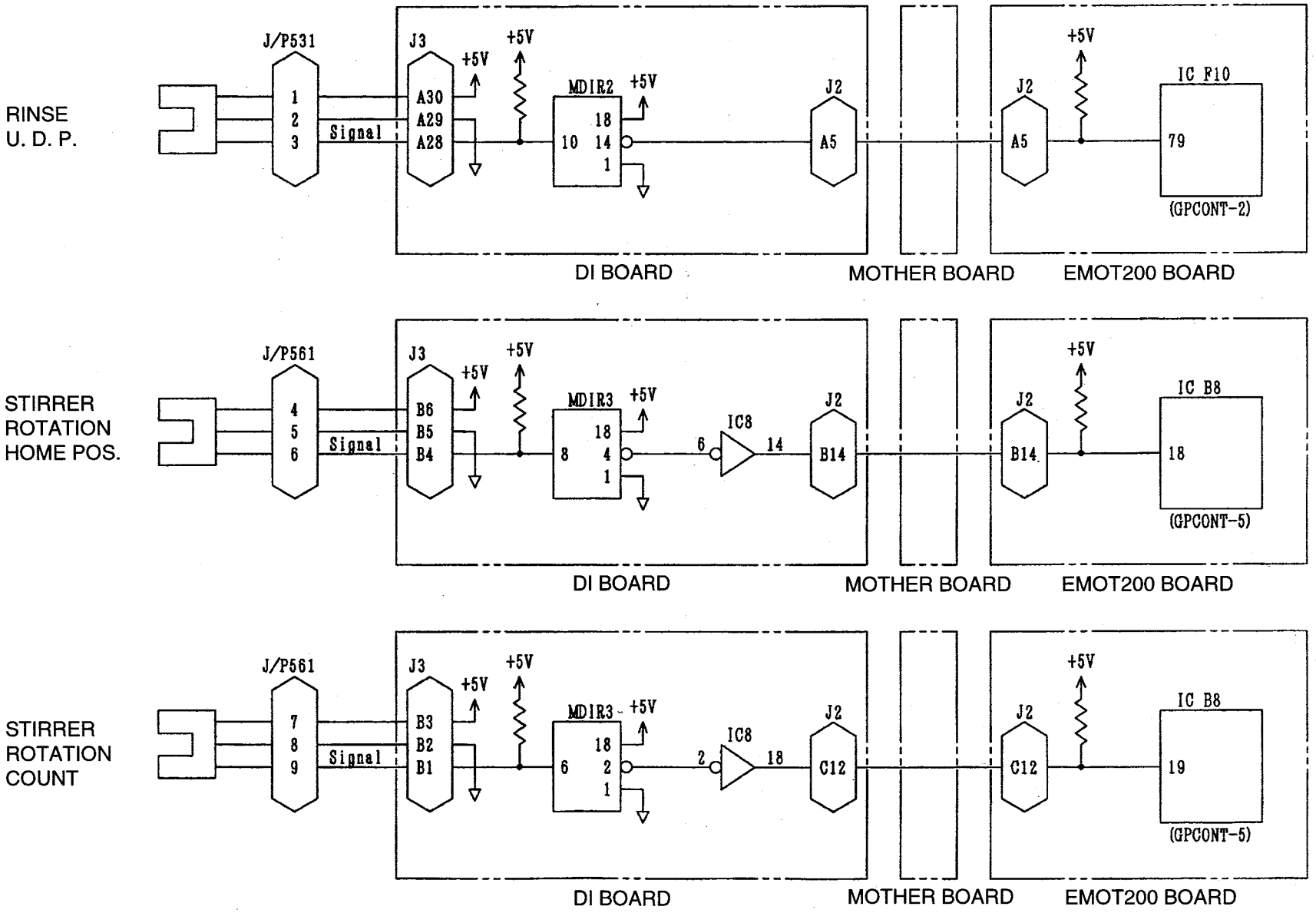
R. ARM
ROTATION
HOME POS.

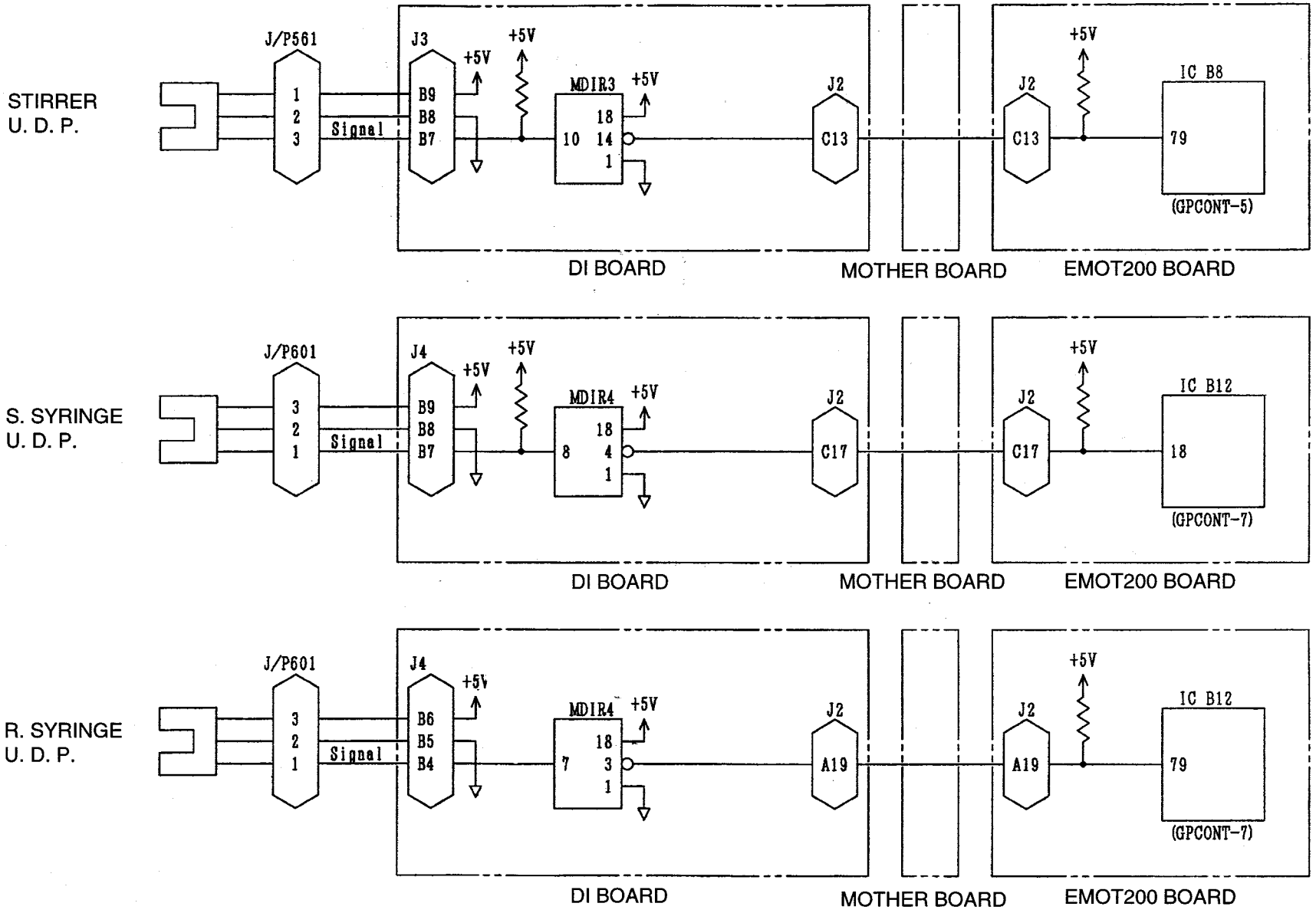


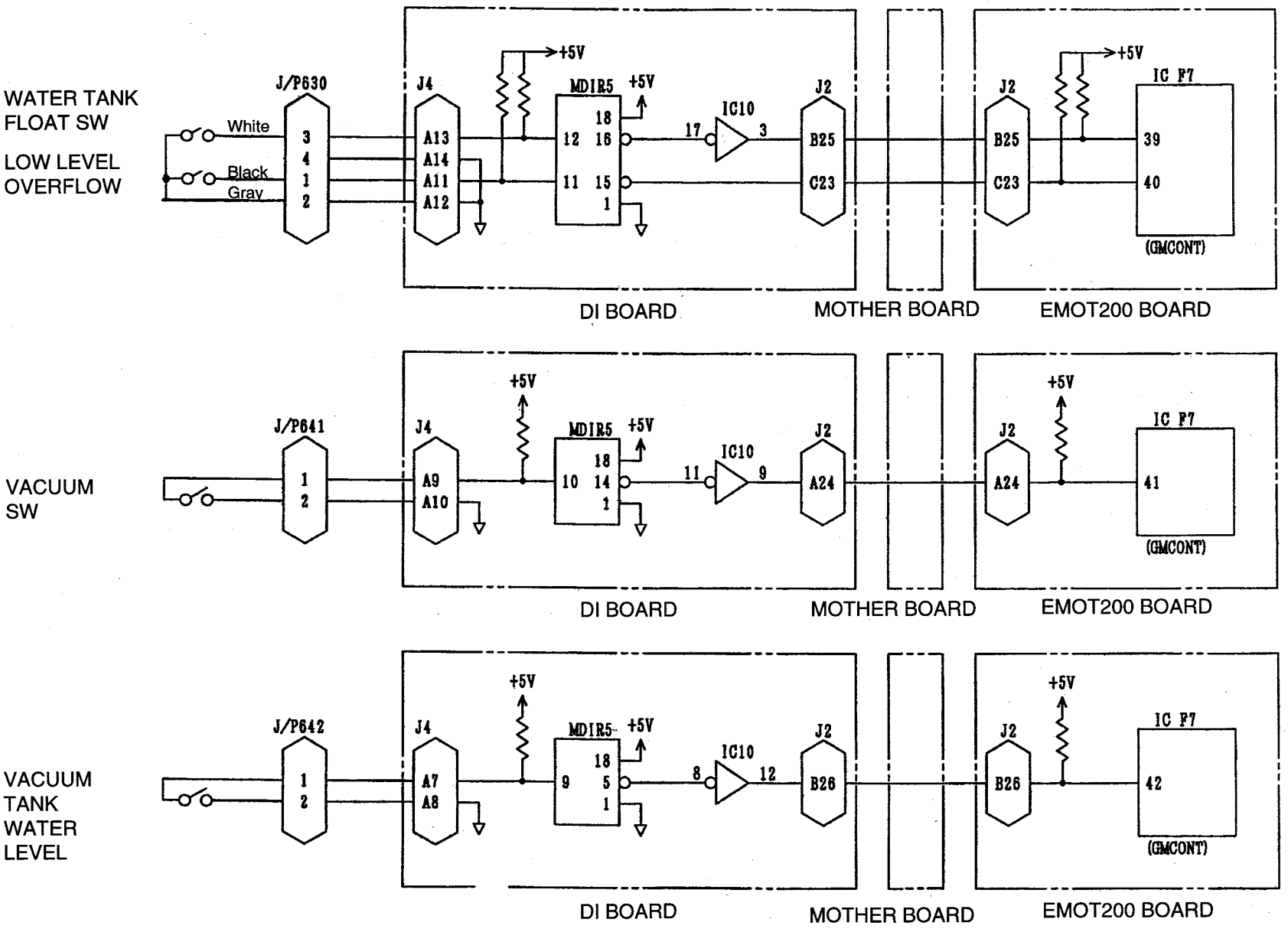
R. ARM
U. D. P.

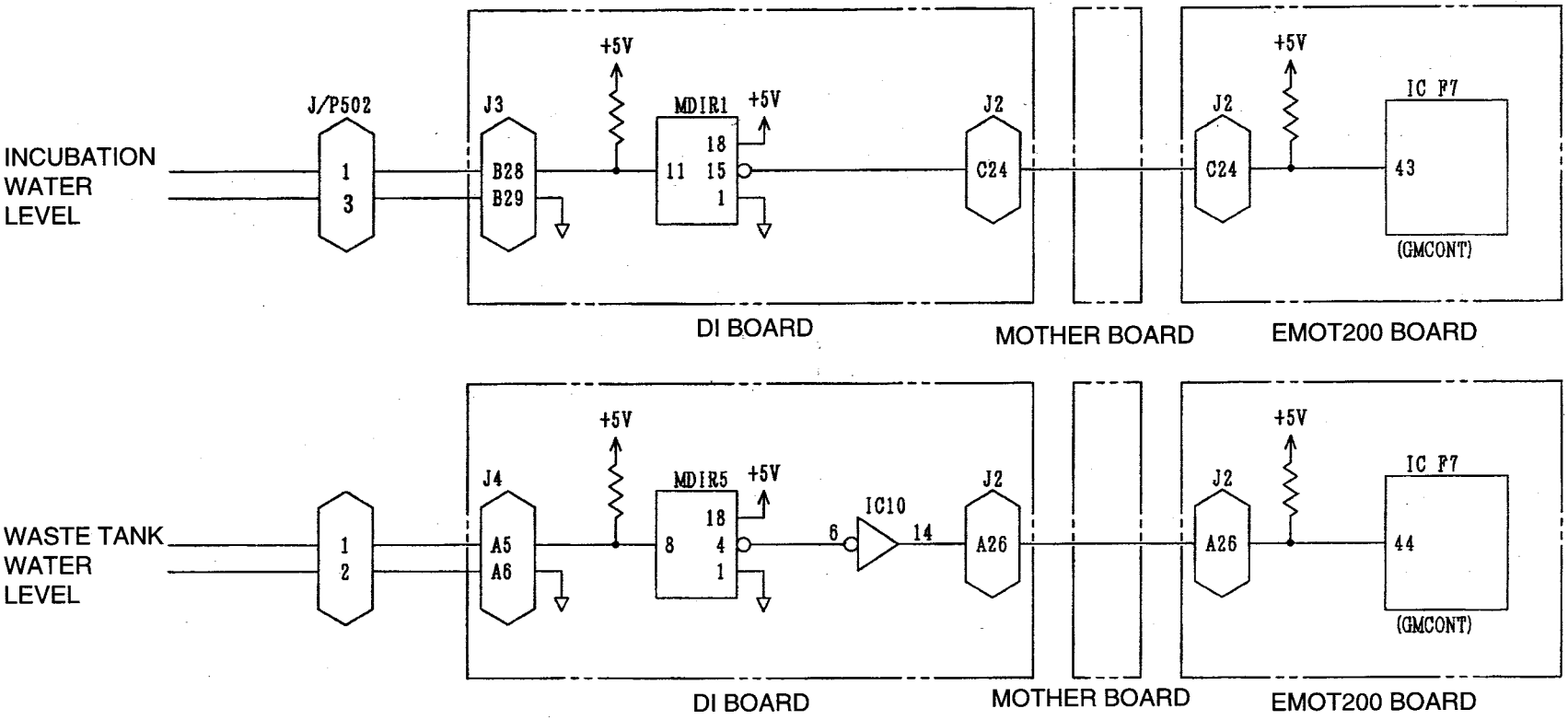



S. PROBE LIQUID LEVEL SENSOR
S. ARM ABNORMAL DESCENT DETECTION
+5V
J3
J4
IC1
J1
-15V
+15V
AG
J2
J541
J551
J3
A19
A20
A21
A17
A18
B13
B14
B15
B11
B12
MDIR2
MDIR1
J2
A8
B10
A11
C11
IC F12
IC F13
80
27
(GPCONT-3)
(GPCONT-4)
E. SENSOR BOARD
DI BOARD
MOTHER BOARD
EMOT200 BOARD

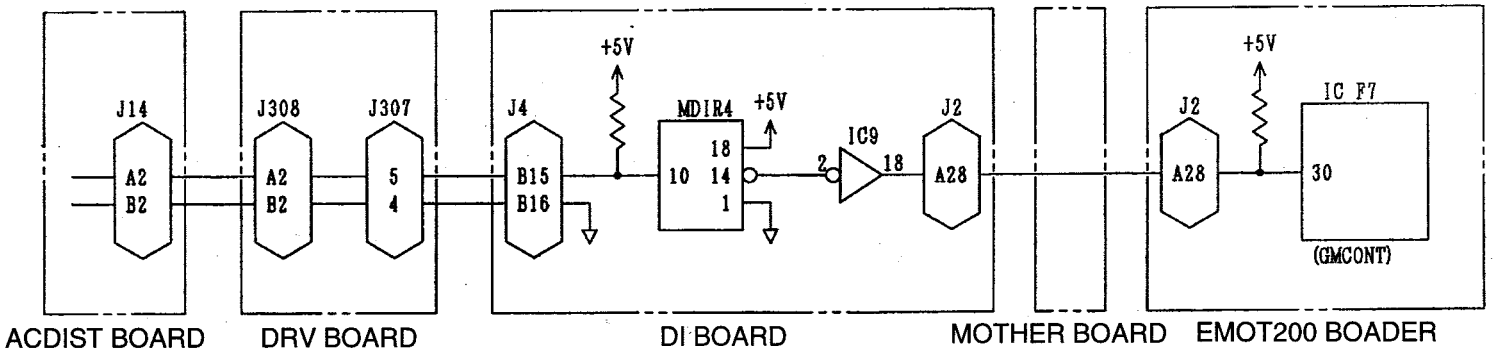

RINSE
U. D. P.
J/P531
1
2
3
Signal
J3
A30
A29
A28
+5V
+5V
MDIR2
+5V
18
10
14
1
J2
A5
DI BOARD
MOTHER BOARD
J2
A5
+5V
IC F10
79
(GPCONT-2)
EMOT200 BOARD
STIRRER
ROTATION
HOME POS.
J/P561
4
5
6
Signal
J3
B6
B5
B4
+5V
+5V
MDIR3
+5V
18
8
4
1
IC8
6
14
J2
B14
DI BOARD
MOTHER BOARD
J2
B14
+5V
IC B8
18
(GPCONT-5)
EMOT200 BOARD
STIRRER
ROTATION
COUNT
J/P561
7
8
9
Signal
J3
B3
B2
B1
+5V
+5V
MDIR3
+5V
18
6
2
1
IC8
2
18
J2
C12
DI BOARD
MOTHER BOARD
J2
C12
+5V
IC B8
19
(GPCONT-5)
EMOT200 BOARD


STIRRER
U. D. P.
J/P561
1
2
3
Signal
J3
B9
B8
B7
+5V
+5V
MDIR3
+5V
18
10
14
1
J2
C13
DI BOARD
MOTHER BOARD
J2
C13
+5V
IC B8
79
(GPCONT-5)
EMOT200 BOARD
S. SYRINGE
U. D. P.
J/P601
3
2
1
Signal
J4
B9
B8
B7
+5V
+5V
MDIR4
+5V
18
8
4
1
J2
C17
DI BOARD
MOTHER BOARD
J2
C17
+5V
IC B12
18
(GPCONT-7)
EMOT200 BOARD
R. SYRINGE
U. D. P.
J/P601
3
2
1
Signal
J4
B6
B5
B4
+5V
MDIR4
+5V
18
7
3
1
J2
A19
DI BOARD
MOTHER BOARD
J2
A19
+5V
IC B12
79
(GPCONT-7)
EMOT200 BOARD

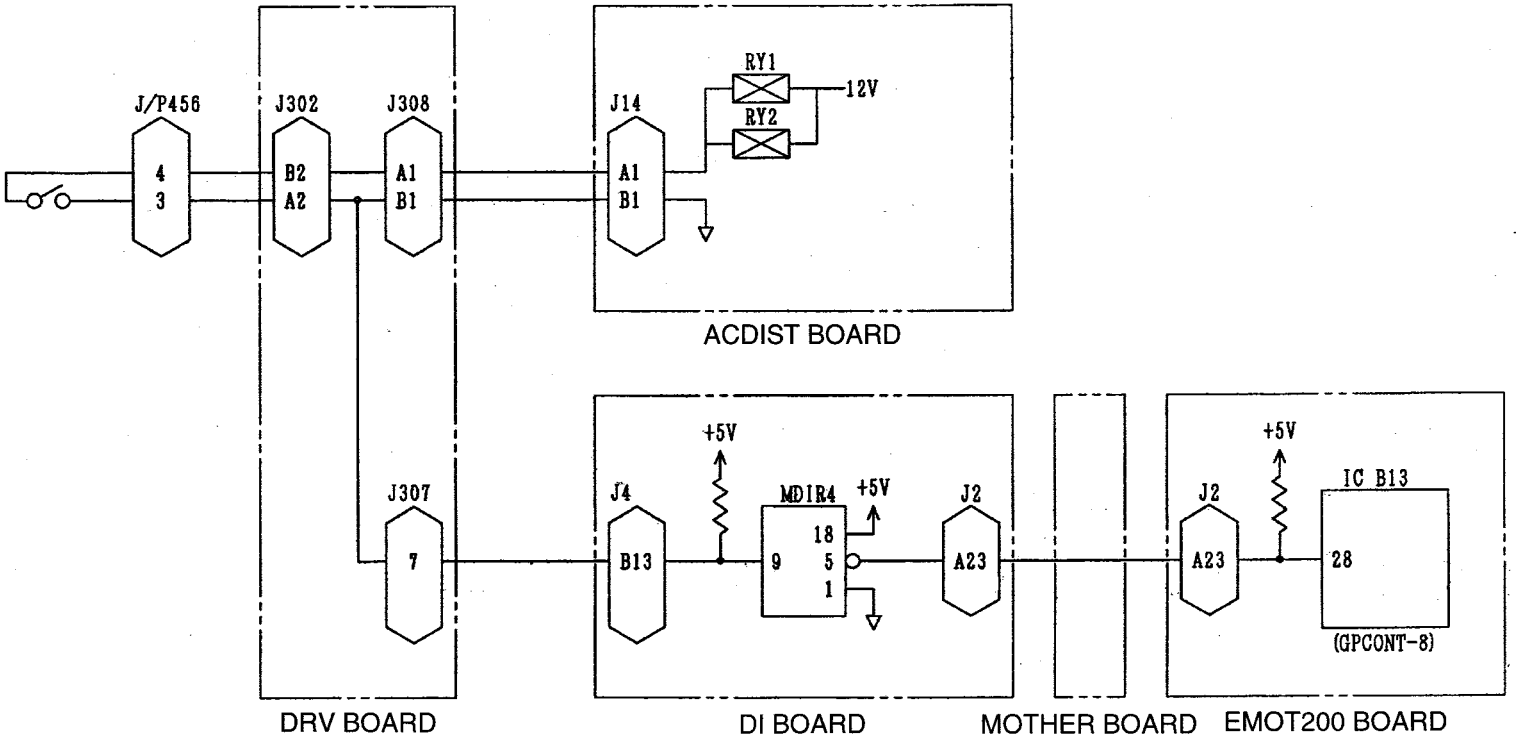

WATER TANK
FLOAT SW
LOW LEVEL
OVERFLOW
White
Black
Gray
J/P630
3
4
1
2
J4
A13
A14
A11
A12
+5V
MDIR5
+5V
18
12
16
11
15
1
17
IC10
3
J2
B25
C23
J2
B25
C23
+5V
IC F7
39
40
(GMCONT)
DI BOARD
MOTHER BOARD
EMOT200 BOARD
VACUUM
SW
J/P641
1
2
J4
A9
A10
+5V
MDIR5
+5V
18
10
14
1
11
IC10
9
J2
A24
J2
A24
+5V
IC F7
41
(GMCONT)
DI BOARD
MOTHER BOARD
EMOT200 BOARD
VACUUM
TANK
WATER
LEVEL
J/P642
1
2
J4
A7
A8
+5V
MDIR5
+5V
18
9
5
1
8
IC10
12
J2
B26
J2
B26
+5V
IC F7
42
(GMCONT)
DI BOARD
MOTHER BOARD
EMOT200 BOARD

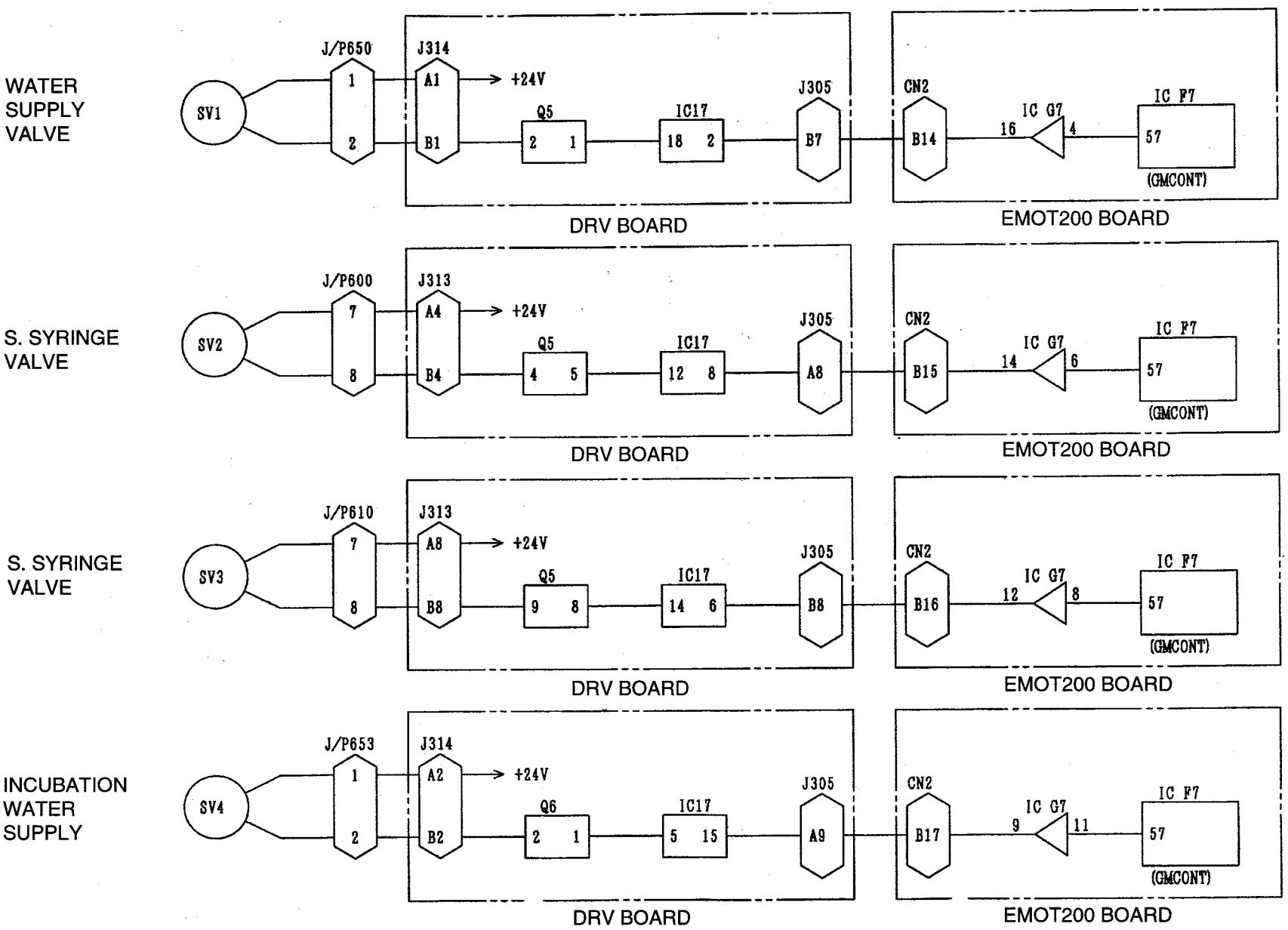

INCUBATION
WATER
LEVEL
J/P502
1
3
J3
B28
B29
+5V
MDIR1
+5V
18
11
15
1
J2
C24
DI BOARD
MOTHER BOARD
J2
C24
+5V
IC F7
43
(GMCONT)
EMOT200 BOARD
WASTE TANK
WATER
LEVEL
1
2
J4
A5
A6
+5V
MDIR5
+5V
18
8
4
1
IC10
6
14
J2
A26
DI BOARD
MOTHER BOARD
J2
A26
+5V
IC F7
44
(GMCONT)
EMOT200 BOARD

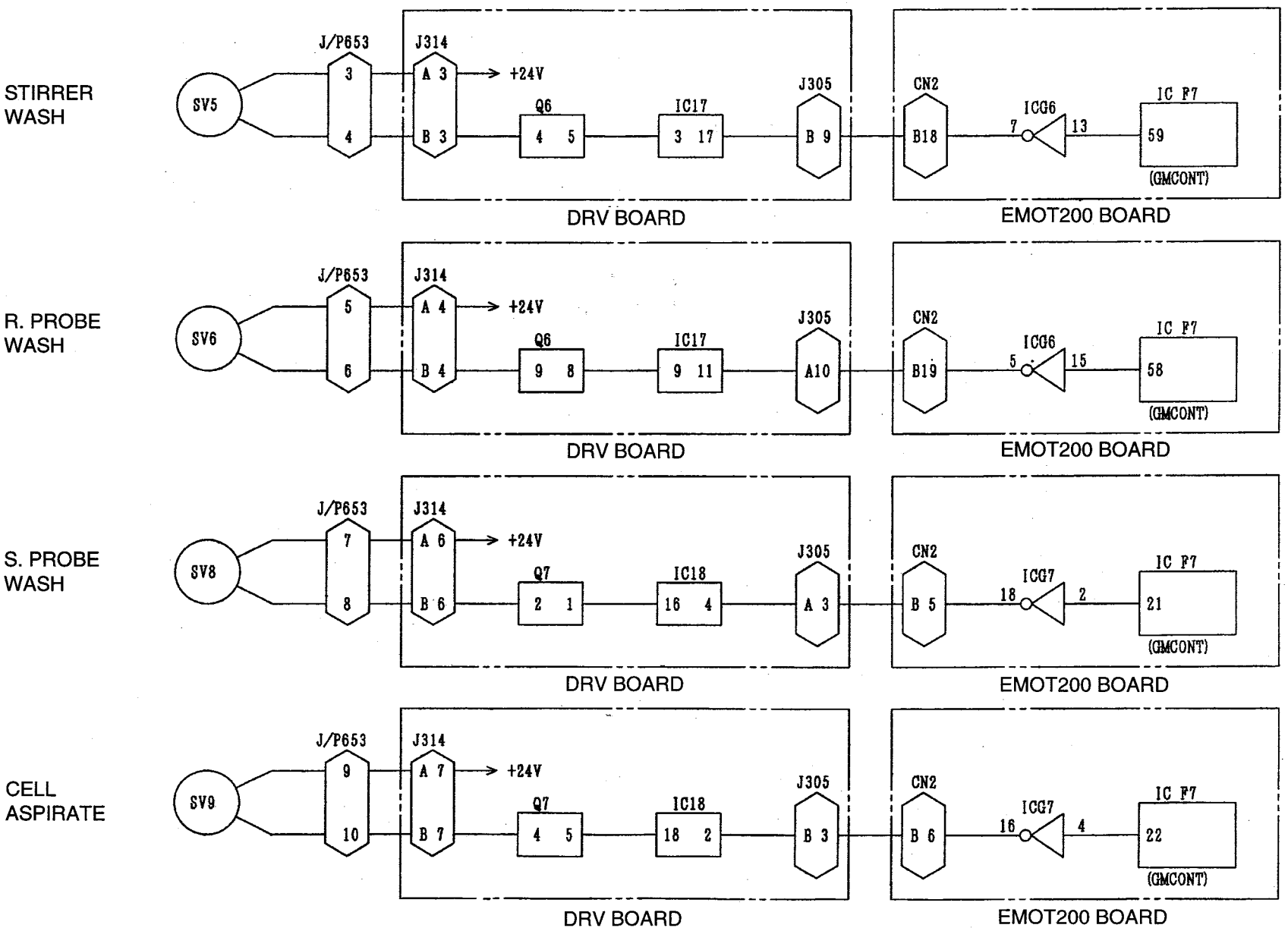
AC FUSE
ALARM

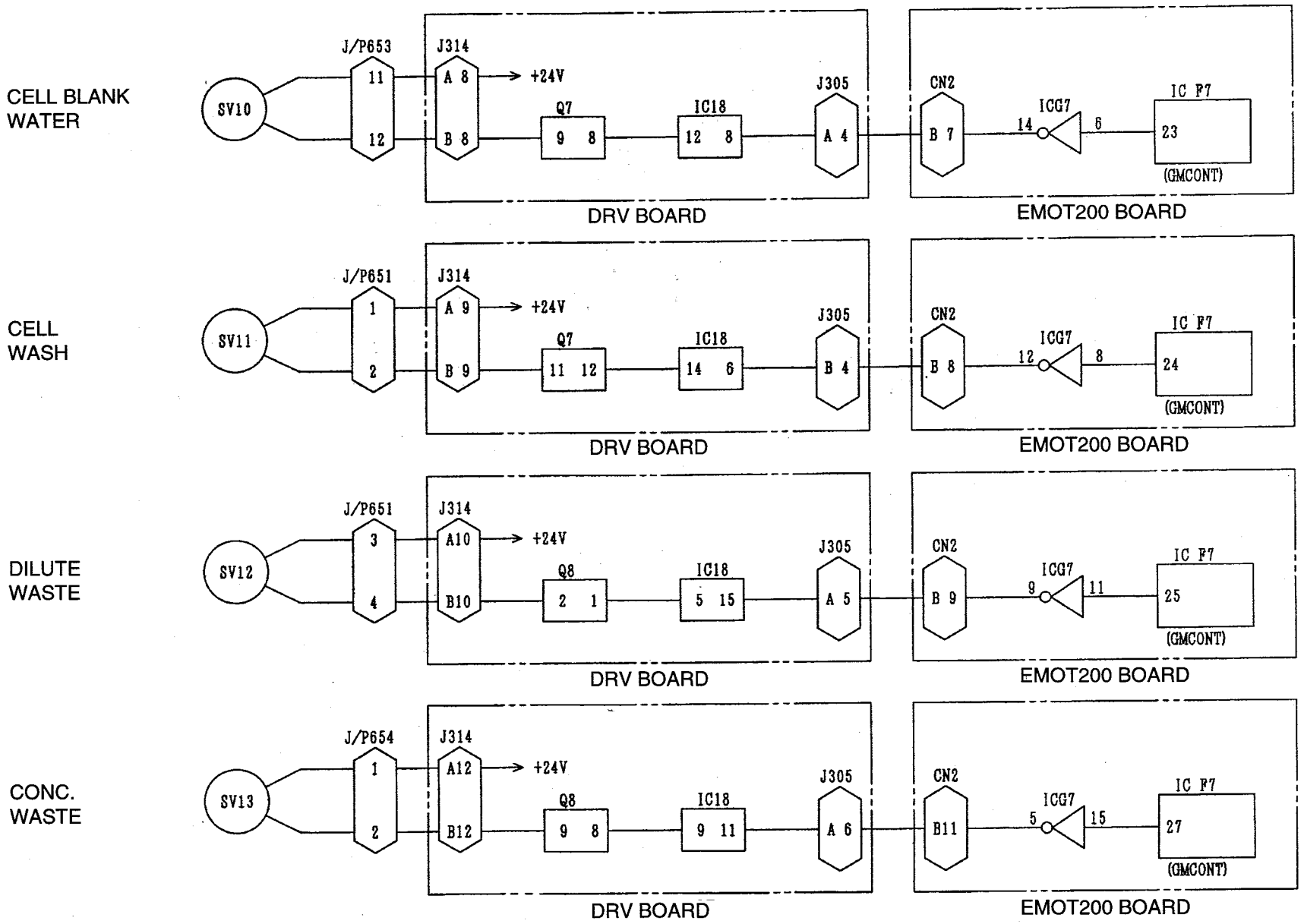


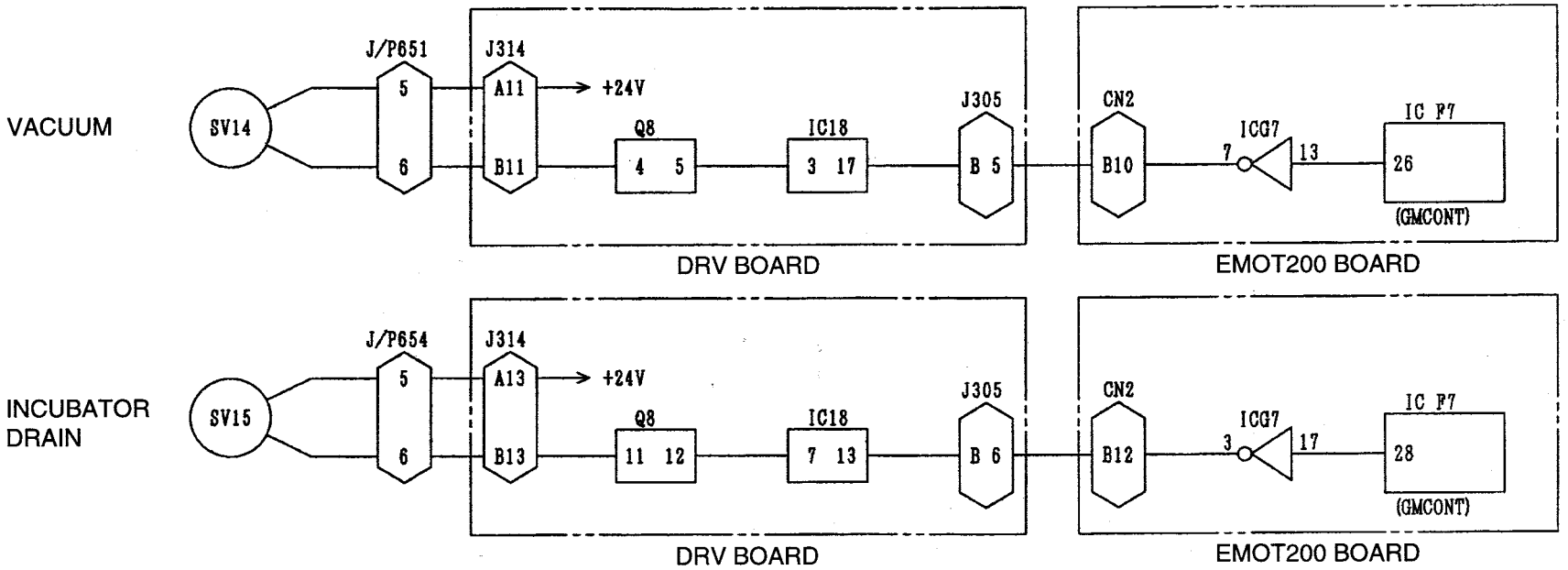
SOURCE
SW

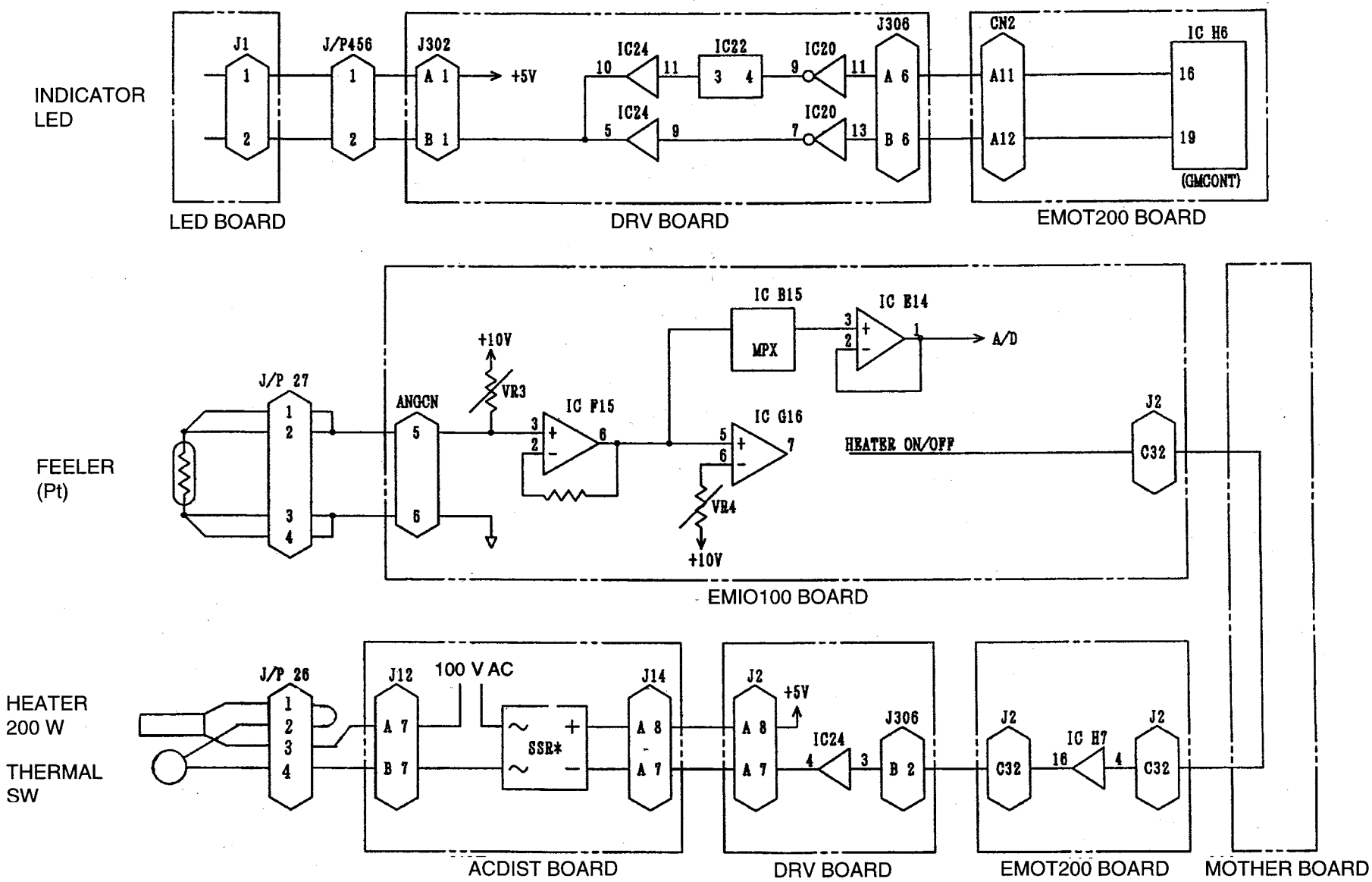


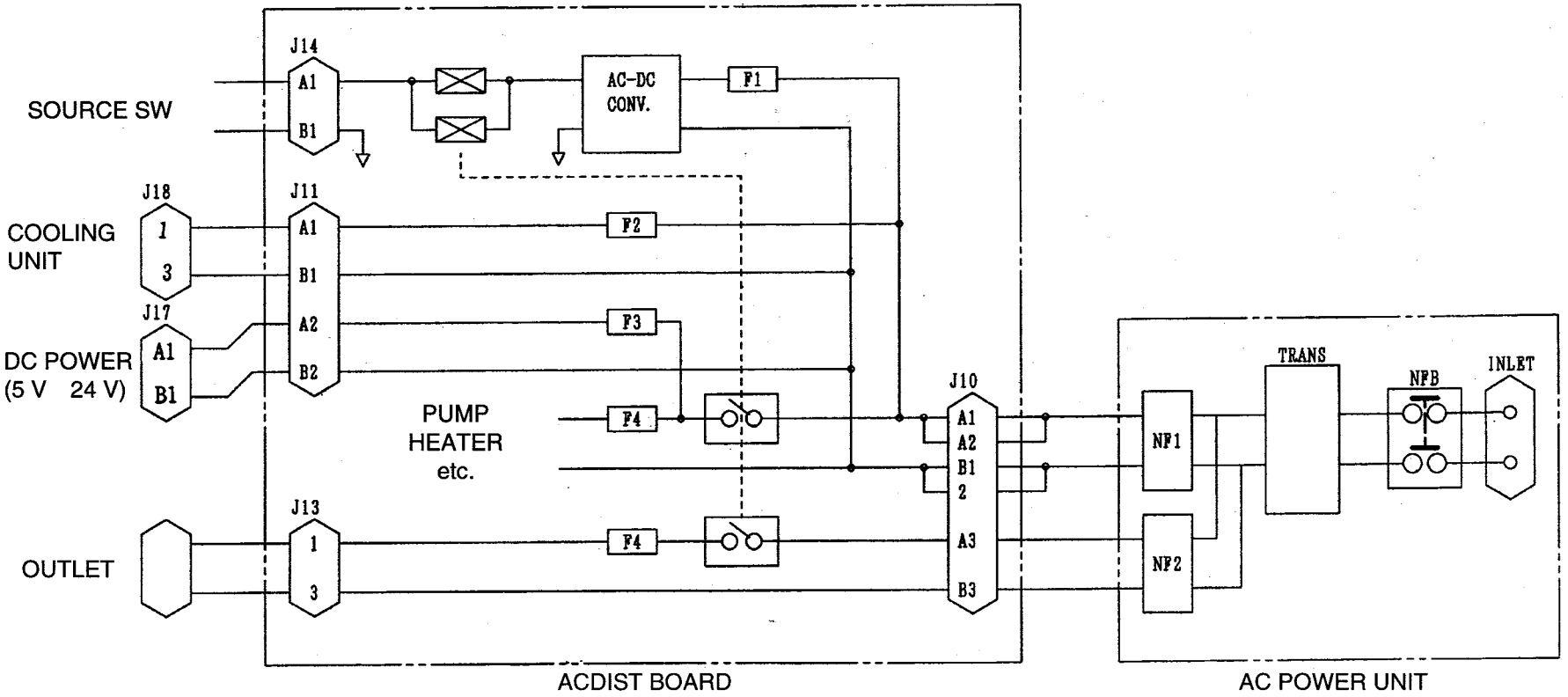

WATER SUPPLY VALVE
SV1
J/P650
1
2
J314
A1
B1
+24V
Q5
2 1
IC17
18 2
J305
B7
CN2
B14
IC G7
16
4
IC F7
57
(GMCONT)
DRV BOARD
EMOT200 BOARD
S. SYRINGE VALVE
SV2
J/P600
7
8
J313
A4
B4
+24V
Q5
4 5
IC17
12 8
J305
A8
CN2
B15
IC G7
14
6
IC F7
57
(GMCONT)
DRV BOARD
EMOT200 BOARD
S. SYRINGE VALVE
SV3
J/P610
7
8
J313
A8
B8
+24V
Q5
9 8
IC17
14 6
J305
B8
CN2
B16
IC G7
12
8
IC F7
57
(GMCONT)
DRV BOARD
EMOT200 BOARD
INCUBATION WATER SUPPLY
SV4
J/P653
1
2
J314
A2
B2
+24V
Q6
2 1
IC17
5 15
J305
A9
CN2
B17
IC G7
9
11
IC F7
57
(GMCONT)
DRV BOARD
EMOT200 BOARD


STIRRER WASH
SV5
J/P653
3
4
J314
A 3
B 3
+24V
Q6
4 5
IC17
3 17
J305
B 9
CN2
B18
ICG6
7
13
IC F7
59
(GMCONT)
DRV BOARD
EMOT200 BOARD
R. PROBE WASH
SV6
J/P653
5
6
J314
A 4
B 4
+24V
Q6
9 8
IC17
9 11
J305
A10
CN2
B19
ICG6
5
15
IC F7
58
(GMCONT)
DRV BOARD
EMOT200 BOARD
S. PROBE WASH
SV8
J/P653
7
8
J314
A 6
B 6
+24V
Q7
2 1
IC18
16 4
J305
A 3
CN2
B 5
ICG7
18
2
IC F7
21
(GMCONT)
DRV BOARD
EMOT200 BOARD
CELL ASPIRATE
SV9
J/P653
9
10
J314
A 7
B 7
+24V
Q7
4 5
IC18
18 2
J305
B 3
CN2
B 6
ICG7
16
4
IC F7
22
(GMCONT)
DRV BOARD
EMOT200 BOARD

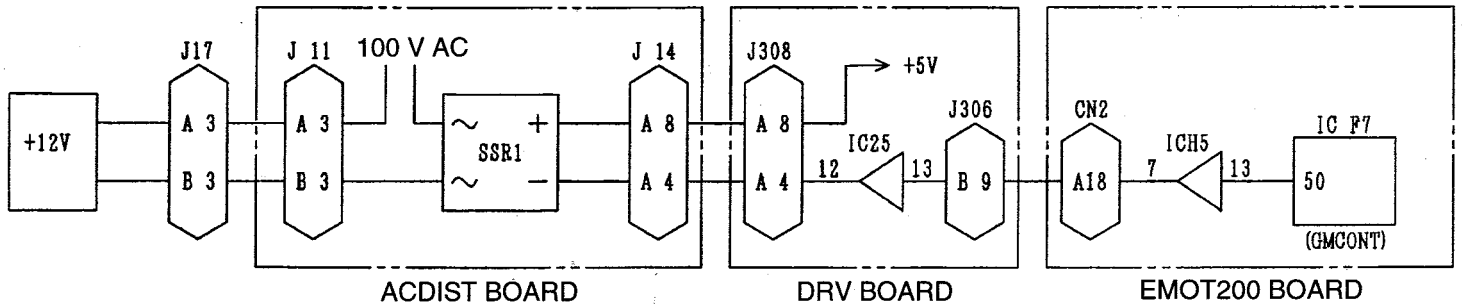

CELL BLANK WATER
SV10
J/P653
11
12
J314
A 8
B 8
+24V
Q7
9 8
IC18
12 8
J305
A 4
DRV BOARD
CN2
B 7
IC67
14
6
IC F7
23
(GMCONT)
EMOT200 BOARD
CELL WASH
SV11
J/P651
1
2
J314
A 9
B 9
+24V
Q7
11 12
IC18
14 6
J305
B 4
DRV BOARD
CN2
B 8
IC67
12
8
IC F7
24
(GMCONT)
EMOT200 BOARD
DILUTE WASTE
SV12
J/P651
3
4
J314
A10
B10
+24V
Q8
2 1
IC18
5 15
J305
A 5
DRV BOARD
CN2
B 9
IC67
9
11
IC F7
25
(GMCONT)
EMOT200 BOARD
CONC. WASTE
SV13
J/P654
1
2
J314
A12
B12
+24V
Q8
9 8
IC18
9 11
J305
A 6
DRV BOARD
CN2
B11
IC67
5
15
IC F7
27
(GMCONT)
EMOT200 BOARD


VACUUM
SV14
J/P651
5
6
J314
A11
B11
+24V
Q8
4 5
IC18
3 17
J305
B 5
CN2
B10
IC G7
7
13
IC F7
26
(GMCONT)
DRV BOARD
EMOT200 BOARD
INCUBATOR DRAIN
SV15
J/P654
5
6
J314
A13
B13
+24V
Q8
11 12
IC18
7 13
J305
B 6
CN2
B12
IC G7
3
17
IC F7
28
(GMCONT)
DRV BOARD
EMOT200 BOARD

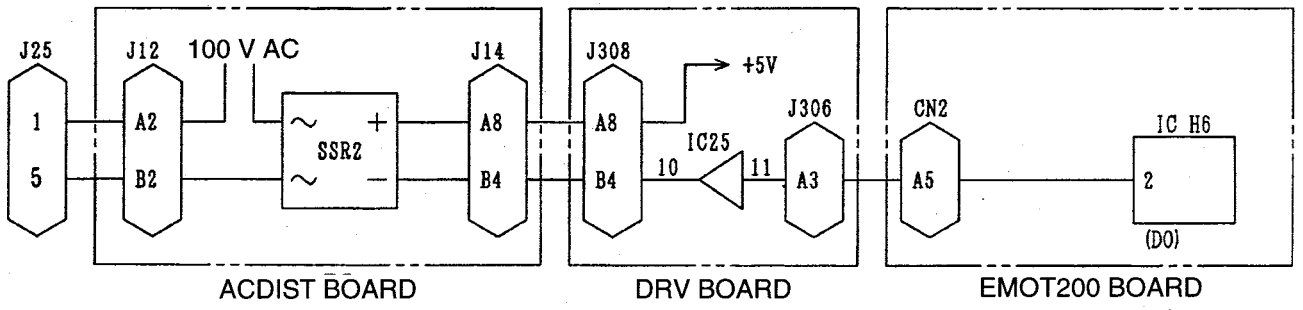

INDICATOR
LED
J1
J/P456
J302
+5V
IC24
IC22
IC20
J306
CN2
IC H6
A11
A12
16
19
(GMCONT)
LED BOARD
DRV BOARD
EMOT200 BOARD
FEELER
(Pt)
J/P 27
ANGCN
+10V
VR3
IC F15
IC B15
MPX
IC E14
A/D
IC G16
HEATER ON/OFF
J2
C32
VR4
EMIO100 BOARD
HEATER
200 W
THERMAL
SW
J/P 26
J12
100 V AC
SSR*
J14
IC H7
ACDIST BOARD
DRV BOARD
EMOT200 BOARD
MOTHER BOARD

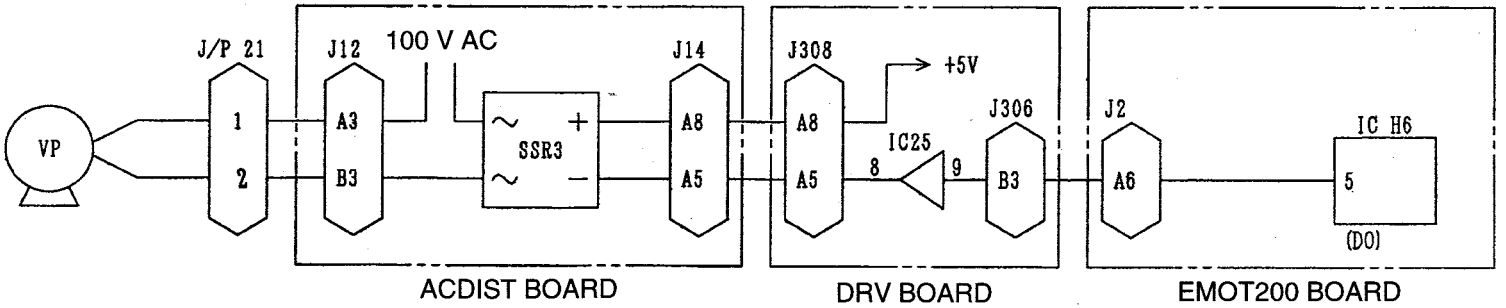

SOURCE SW
COOLING UNIT
DC POWER (5 V 24 V)
OUTLET
PUMP HEATER etc.
J14
A1
B1
AC-DC CONV.
F1
J18
1
3
J11
A1
B1
A2
B2
F2
F3
F4
J17
A1
B1
J13
1
3
F4
J10
A1
A2
B1
2
A3
B3
ACDIST BOARD
NF1
NF2
TRANS
NFB
INLET
AC POWER UNIT

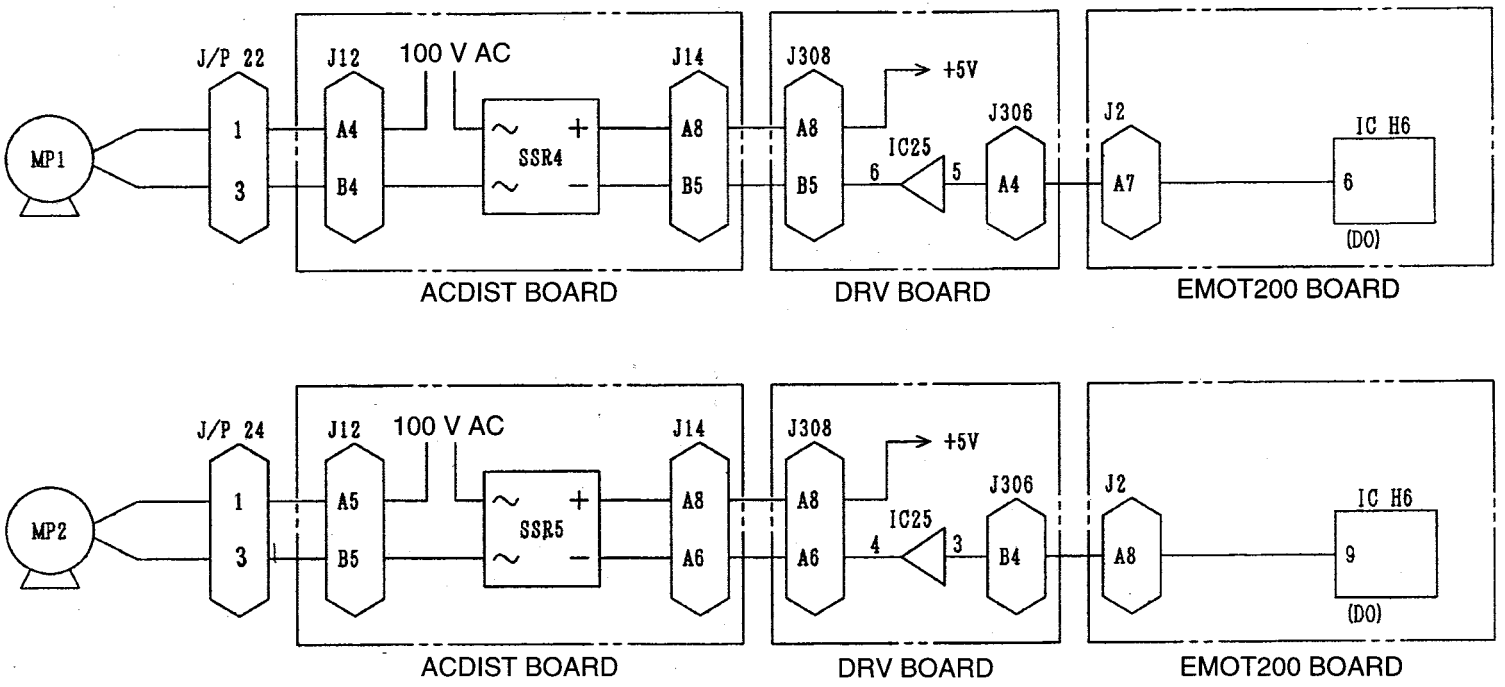
DC POWER SUPPLY (LAMP)

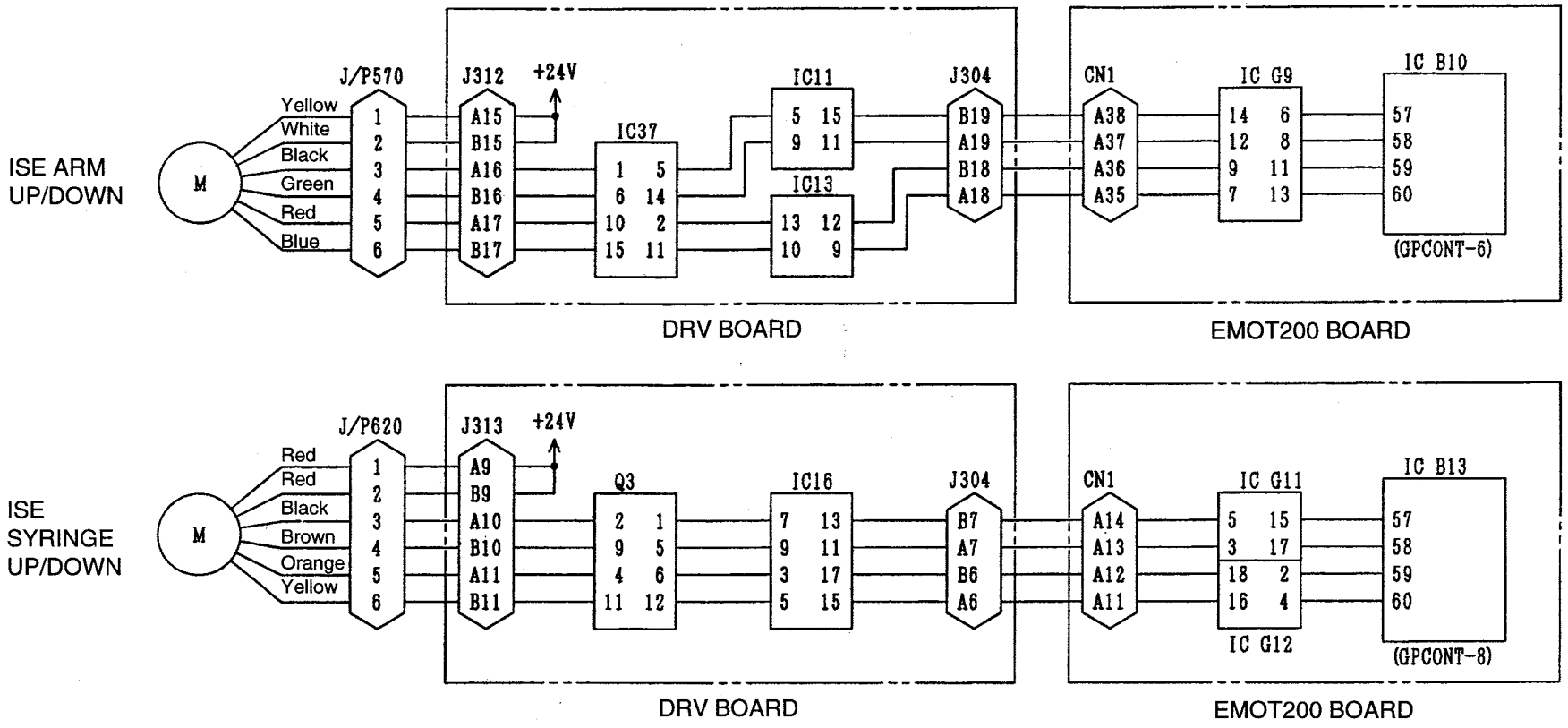


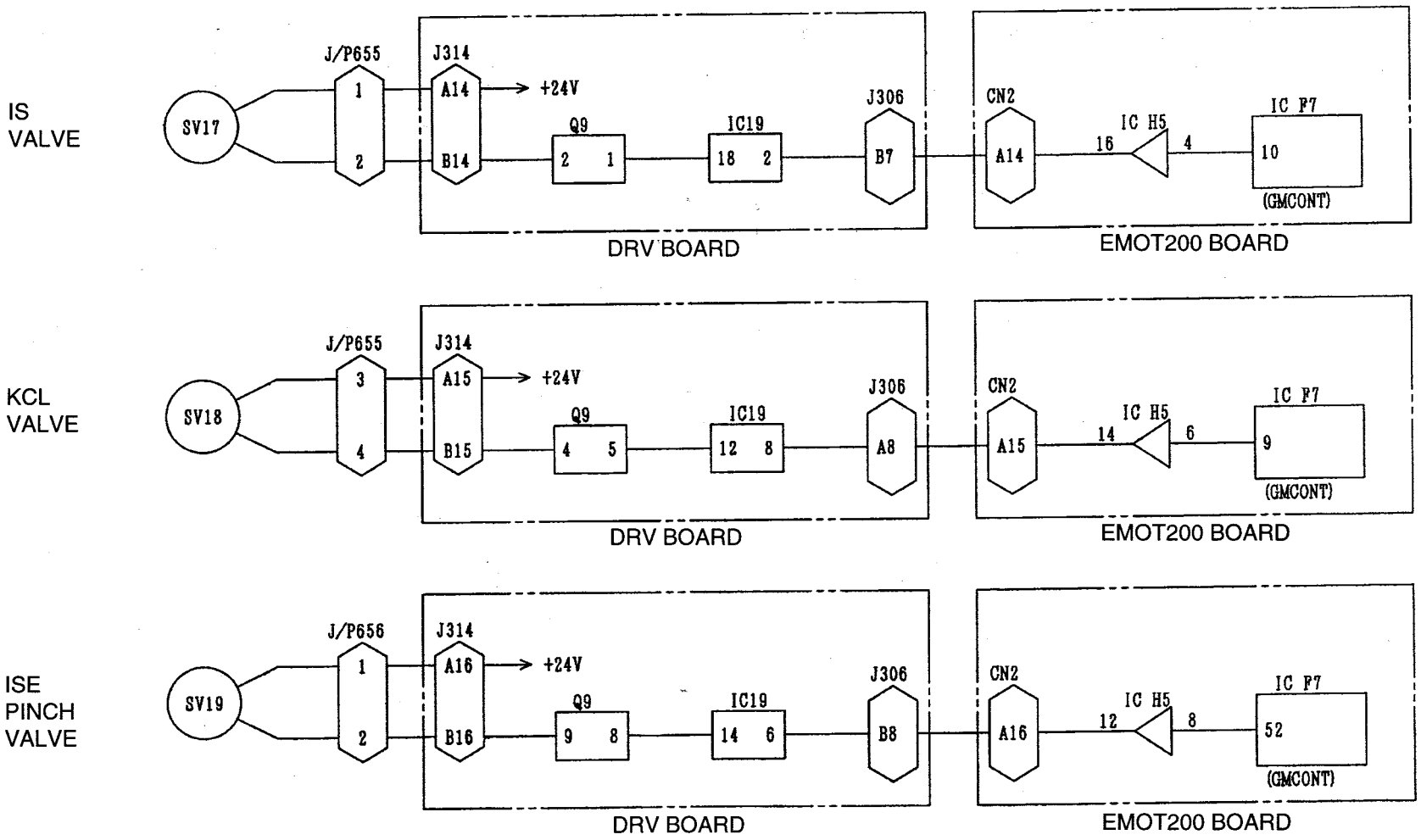
MINI-CLEAR SUPPLY REQUEST

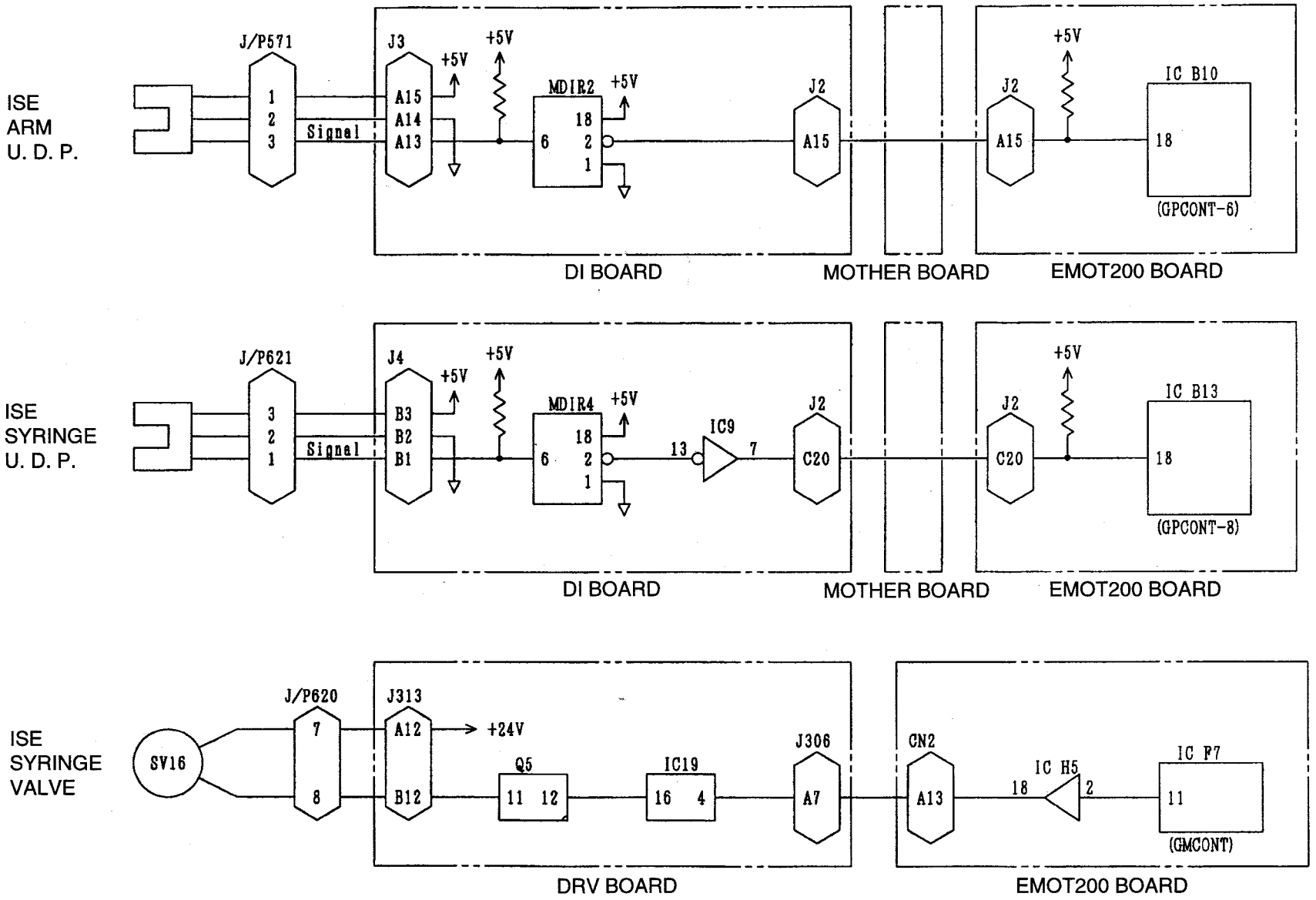





J/P 22
J12
100 V AC
J14
J308
+5V
J306
J2
IC H6
MP1
1
3
A4
B4
SSR4
A8
B5
A8
B5
IC25
6
5
A4
A7
6
(DO)
ACDIST BOARD
DRV BOARD
EMOT200 BOARD
J/P 24
J12
100 V AC
J14
J308
+5V
J306
J2
IC H6
MP2
1
3
A5
B5
SSR5
A8
A6
A8
A6
IC25
4
3
B4
A8
9
(DO)
ACDIST BOARD
DRV BOARD
EMOT200 BOARD


ISE ARM
UP/DOWN
M
Yellow
White
Black
Green
Red
Blue
J/P570
1
2
3
4
5
6
J312
A15
B15
A16
B16
A17
B17
+24V
IC37
1 5
6 14
10 2
15 11
IC11
5 15
9 11
IC13
13 12
10 9
J304
B19
A19
B18
A18
DRV BOARD
CN1
A38
A37
A36
A35
IC G9
14 6
12 8
9 11
7 13
IC B10
57
58
59
60
(GPCONT-6)
EMOT200 BOARD
ISE
SYRINGE
UP/DOWN
M
Red
Red
Black
Brown
Orange
Yellow
J/P620
1
2
3
4
5
6
J313
A9
B9
A10
B10
A11
B11
+24V
Q3
2 1
9 5
4 6
11 12
IC16
7 13
9 11
3 17
5 15
J304
B7
A7
B6
A6
DRV BOARD
CN1
A14
A13
A12
A11
IC G11
5 15
3 17
18 2
16 4
IC G12
IC B13
57
58
59
60
(GPCONT-8)
EMOT200 BOARD


IS
VALVE
SV17
J/P655
1
2
J314
A14
B14
+24V
Q9
2 1
IC19
18 2
J306
B7
DRV BOARD
CN2
A14
IC H5
16
4
IC F7
10
(GMCONT)
EMOT200 BOARD
KCL
VALVE
SV18
J/P655
3
4
J314
A15
B15
+24V
Q9
4 5
IC19
12 8
J306
A8
DRV BOARD
CN2
A15
IC H5
14
6
IC F7
9
(GMCONT)
EMOT200 BOARD
ISE
PINCH
VALVE
SV19
J/P656
1
2
J314
A16
B16
+24V
Q9
9 8
IC19
14 6
J306
B8
DRV BOARD
CN2
A16
IC H5
12
8
IC F7
52
(GMCONT)
EMOT200 BOARD


ISE
ARM
U. D. P.
J/P571
1
2
3
Signal
J3
A15
A14
A13
+5V
+5V
MDIR2
+5V
18
6
2
1
J2
A15
DI BOARD
MOTHER BOARD
J2
+5V
IC B10
A15
18
(GPCONT-6)
EMOT200 BOARD
ISE
SYRINGE
U. D. P.
J/P621
3
2
1
Signal
J4
B3
B2
B1
+5V
+5V
MDIR4
+5V
18
6
2
1
IC9
13
7
J2
C20
DI BOARD
MOTHER BOARD
J2
C20
+5V
IC B13
18
(GPCONT-8)
EMOT200 BOARD
ISE
SYRINGE
VALVE
SV16
J/P620
7
8
J313
A12
B12
+24V
Q5
11
12
IC19
16
4
J306
A7
DRV BOARD
CN2
A13
IC H5
18
2
IC F7
11
(GMCONT)
EMOT200 BOARD

12. INSTALLATION

12.0 Analyser unit unpack manual 12-1

12.1 902 Layout and Installation Conditions 12-3

12.2 Check for Quantity 12-6

12.3 Unpacking 12-6

12.4 Setting of Instrument 12-7

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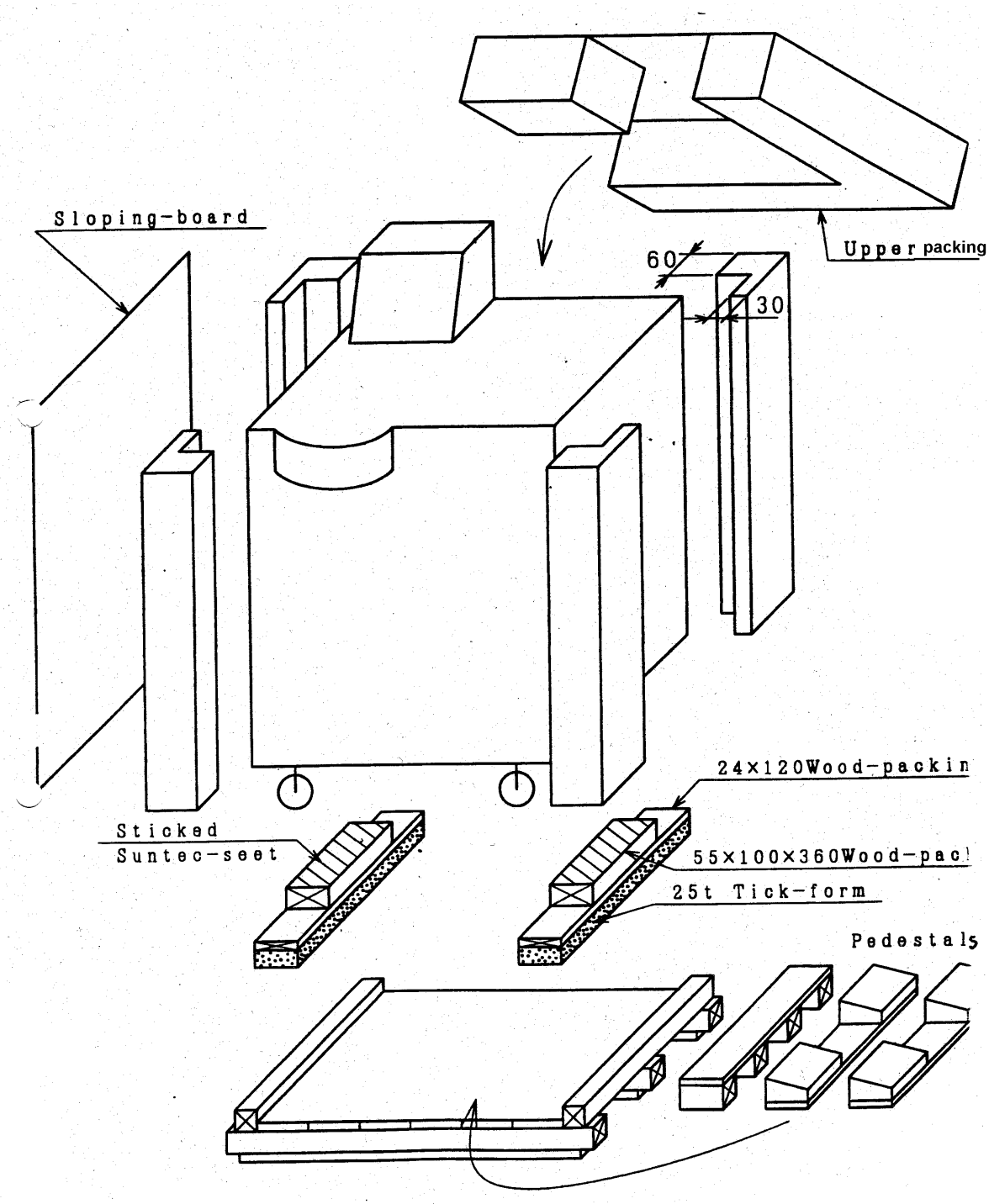
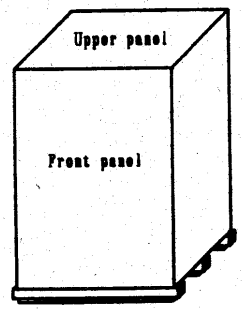
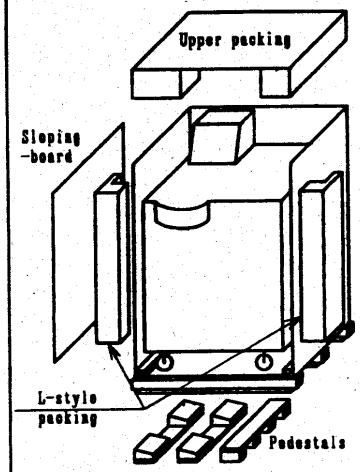
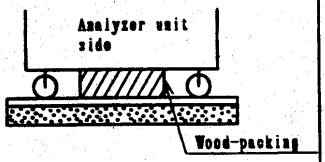
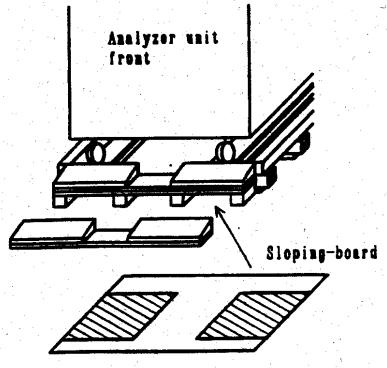
- 12.11.5 Procedure for Initial Setting of LCD Module 12-18

12. INSTALLATION

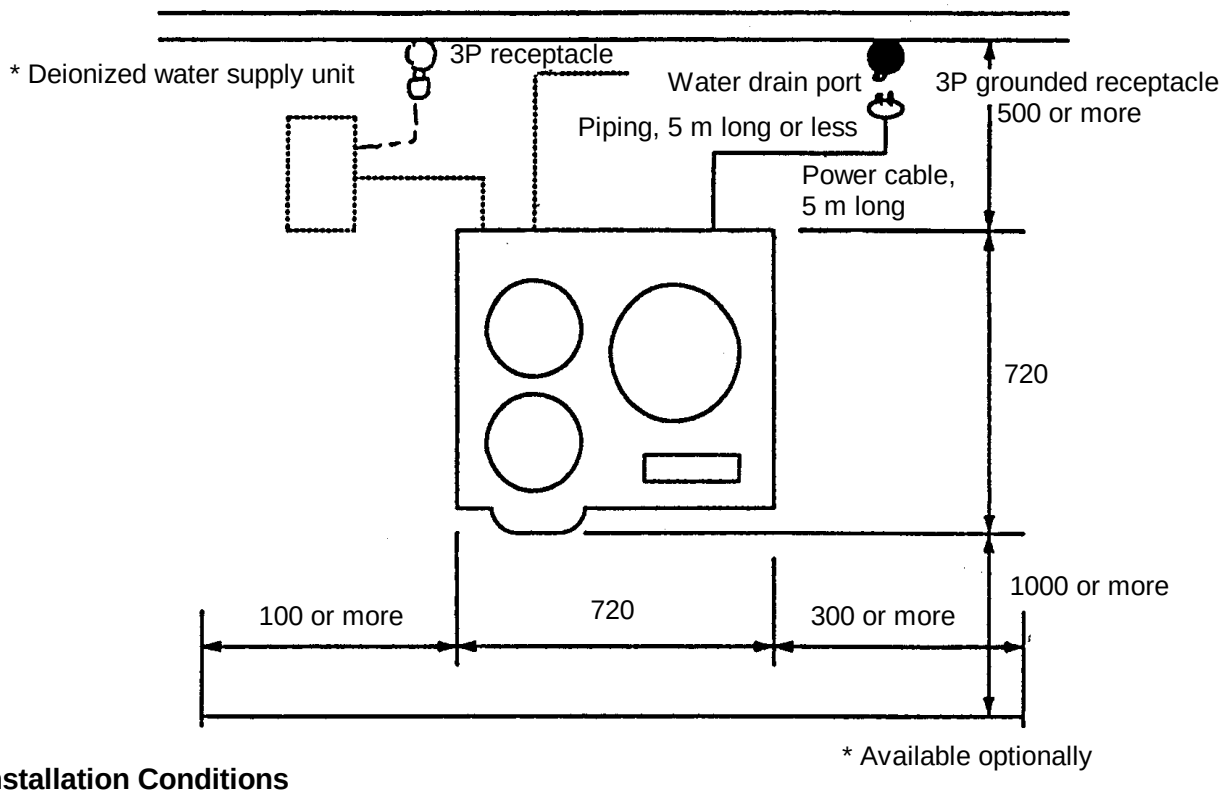
12.0 Analyzer unit unpack manual



Step	Illustration	Mothod of work
1		① Take off the front panel board and the upper panel board of the package.
2		② Take off the upper packing and two L-style packings. ③ Take out a sloping-board whick is enclosed on package-side. and pedestals below analyzer unit.
3		④ Drop wood-packings (▨H55×W100× L360) from both side to inside analyzer unit below.
4		⑤ Lay down three pedestals like illustration. ⑥ Set the sloping-board on pedestals. ⑦ Adjust hight of the sioping-board to that of the package base. ⑧ Utilizing slope take out the analyzer unit holding of it firmly the corners and carefully. (You may take away panels composing package as the occasion demands.)

12. INSTALLATION

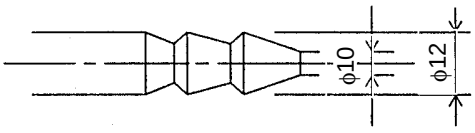
12.1 902 Layout and Installation Conditions



- **Installation Conditions**

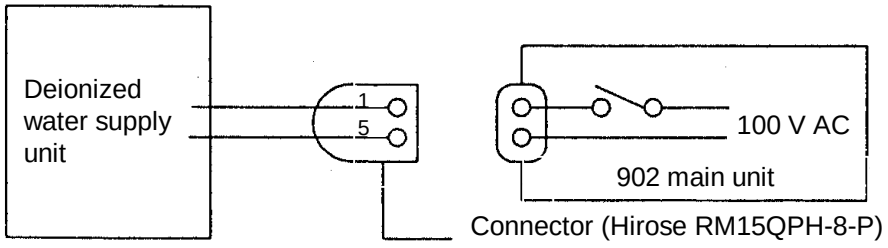
(1)	Space	:	Instrument size 720 (W) × 720 (D) × 1085 (H)
(2)	Weight	:	Approx. 190 kg
(3)	Power requirements	:	100 V AC, 50/60 Hz, 1.5 kVA
(4)	Power receptacle	:	3P grounded receptacle If the receptacle is not grounded, there must be a grounding terminal near it.
(5)	Ambient temperature	:	18 to 30°C (within ±2°C variation during measurement)
(6)	Ambient humidity	:	20 to 80% RH (non-condensing)
(7)	Deionized water supply unit	:	Water pressure 50 - 340 Kpa; 0.5 to 3.5 kgf/cm^2
(8)	Water drain port	:	50 mm or more in opening diameter, 100 mm or less above floor
(9)	Heat dissipation	:	1.3 kcal max.

Table 12-1 Items to Be Prepared by Customer

Item	Specifications	Remarks
Power source	2P grounded receptacle 230 V AC, 1.5 kVA, 1.3 kcal	For BM
	3P grounded receptacle 115 V AC, 1.5 kVA, 1.3 kcal	For BMC
Grounding	3rd class grounding terminal (100 Ω or less with reference to earth)	
Distilled water or deionized water	Approx. 15 L/hr during operation	
Refrigerator	Prepare a refrigerator having the necessary capacity to store reagents and samples.	
Tap water	(a)Water quality : Dionized / destilled water (b)Water pressure : 0.5 to 3.5 kgf/cm^2; 50 to 340 Kpa (c)Water temperature : 30°C or less (d)Faucet diameter : Chemical faucet, 1/2" (approx. 12 mm) in diameter Faucet size 	Conductivity < 1 μs/cm or less, germ-free
Drain port	Prepare a port having a diameter of 50 mm or more within 5 m of drain port at the rear of the main unit and at a height of 100 mm or less above the floor.	

NOTE: Specifications of Deionized Water Supply Unit for Model 902
Described below are the specifications for connection of the deionized water supply unit to the Model 902.

Water quality	:	Neutral water containing no substances that adversely affect measurement, such as deionized water and distilled water
Water supply capacity	:	20 L/hr
Water pressure	:	50-340 Kpa; 0.5-3.5 kgf/cm^2; Conductivity < 1 μs/cm or less germ-free
Main unit intake	:	Connectable to nipple of 16 mm in diameter and 28 mm in length
Control signal	:	Water aspiration via 100 V AC contact signal

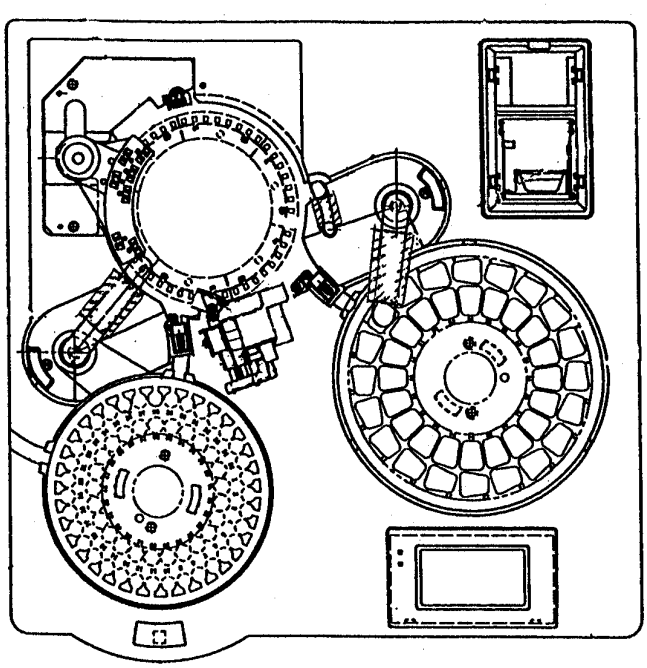


Wiring/piping	:	Within 5 m long

12.2 Check for Quantity

Check each component for quantity referring to the packing list contained in the shipping crate.

12.3 Unpacking



= Cushion
Lower part of reagent dispensing mechanism
Lower part of sampling mechanism
Lower part of stirring mechanism

Fig. 12-2 Analyzer Packed in Shipping Crate

(1) Unpack the shipping crate, and carefully take out the main unit.

(2) Remove tapes, ropes and cushions from the main unit as shown in Fig. 12-2.

12.4 Setting of Instrument

(1) Set the S. disk.

(2) Set the R. disk.

(3) Set a bottle (50 mL) containing undiluted Hitergent solution to channel 40 of the R. disk.

(4) Set the roll paper to the printer.

(5) Set the FD. (drive 1: Parameter Disk, drive 2: Data Disk)

(6) Connect the signal cable leading from the deionized water supply unit.

12.5 Wiring and Piping

(1) Measure the voltage of the power equipment prepared by the customer.

(2) Plug the power cable into the main unit, and fasten the cable with the cable fixture.

(3) Connect the power plug to the power equipment prepared by the customer.

(4) Attach the filter case to the water supply port and push in the water supply tube. Cut the tube according to the distance to the deionized water supply unit, and push the tube into the water supply port of the deionized water supply unit. Fasten the tube with hose bands.

(5) Connect the pipe joint to the low-concentration water drain port. Cut the drain tube according to the distance between the instrument and the drain port prepared by the customer, and connect the tube. The tube should be fastened with hose bands and the pipe joint with the pipe retainer.

(6) Attach the nipple to the high-concentration water drain port, push in the waste solution tube and fasten it with the binder. Put the waste solution tube and waste solution sensor in the waste solution tank.

12.6 Fixing of Instrument

(1) Determine the installation place of the main unit through arrangement with the customer, and fix the main unit by turning the adjuster screws.

(2) Wipe out contaminants from the incubator by use of gauze soaked with 2% Hitergent solution or the like, and inject deionized water into the incubator.

(3) Check if the incubator is at a level by measuring the water level at 3 check points, and adjust the height by turning the adjuster screws.

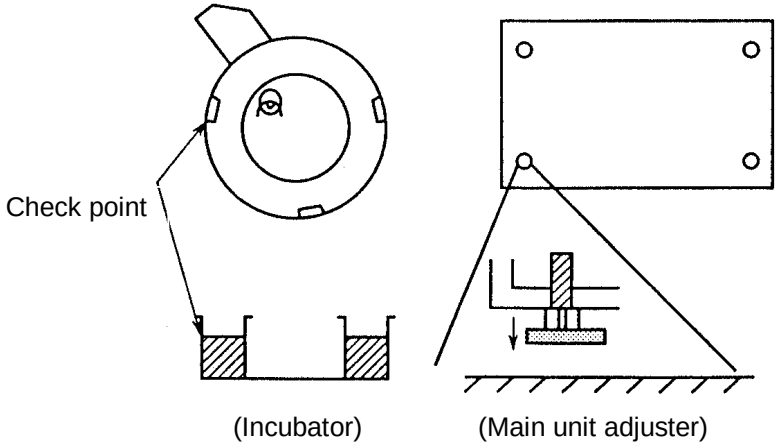


Fig. 12-3 Adjustment of Water Level in Incubator

12.7 Preparation for Analysis

(1) Prepare 2% Hitergent solution in a container, and immerse the reaction cells (6 sets) in the solution. Before turning on power, set all reaction cells.

(2) Fill at least the deionized water tank at least $^{3}/_{4}$ full with deionized water.

(3) Take of the water-return tube (from pump to tank) at the tank-side to de-activate the pump.

(4) When the water raised up in this tube, fix the tube again.

12.8 Operation after Turning On Power

(1) Turn on the main switch.

(2) Turn on the power switch.

(3) The initial screen (copyright notice) appears.

(4) Enter the date.

(5) Execute "Reset" to eliminate air bubbles from each syringe.

(6) Execute "Incubator Water Exchange" 2 or 3 times. Check if Hitergent is injected in the incubator with the R. probe at water exchange.

12.9 Adjustment and Check of Each Part

(1) Adjustment of Sample Probe Position

(a) Place the sample cups at Pos. 1 and W1 on the S. disk, and execute "Probe Adjust [S. Probe (Horiz)]".

(b) Check the respective positions of the probe, sample cup and rinsing bath each time the Execute key is pressed.

(c) Adjust the probe position by hand if deviated above the cell and through pulse adjustment if deviated above the sample cup.

(d) Place the sample cups at Pos. 1, 2 and W1 on the S. disk, and execute "Probe Adjust [S. Probe (Vert)]". The S. probe moves down and the height of the sample cup bottom at each position is measured.

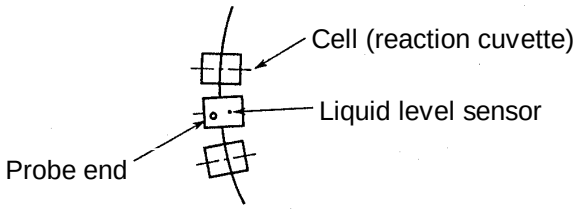


Fig. 12-4 Sample Probe Position

(2) Adjustment of Reagent Probe and Stirring Rod

(a) Place the 50 mL reagent bottle at channel 1 of the reagent disk, and execute "Probe Adjust [R. Probe (Horiz)]".

(b) Check the respective positions of the probe, rinsing bath and reagent bottle each time the EXECUTE key is pressed.

(c) Adjust the probe position by hand if deviated above the cell and through pulse adjustment if deviated above the reagent bottle.

(d) Remove the reagent bottle from the reagent disk, and adjust "Probe Adjust [R. Probe (Vert)]". The R. probe moves down and the height of the reagent bottle bottom is measured.

(e) Adjust the distance between the cell holder assy and stirring rod end by use of the furnished spacer.

(f) Press the Execute key and check the position with reference to the rinsing bath.

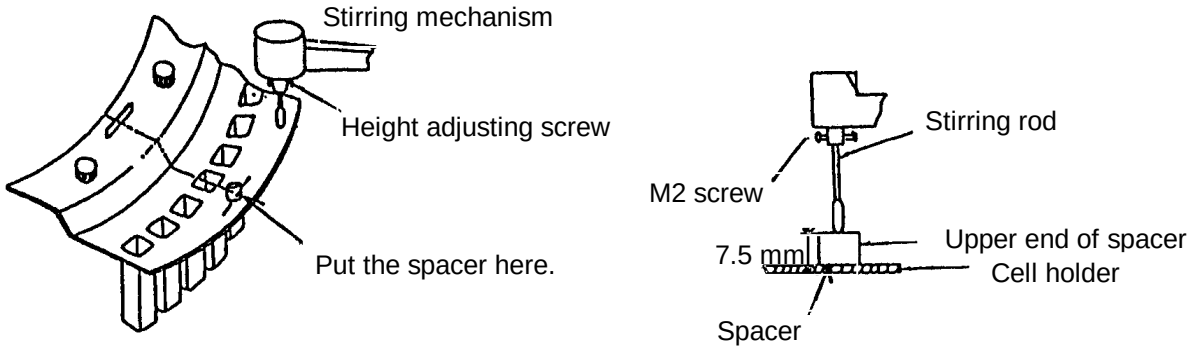


Fig. 12-5 Position of Reagent Probe and Stirring Rod

(3) Check of Rinse Mechanism

(a) Check the distance between the cell and nozzle tip.

(b) Execute "Mechanism Check".

(c) Check the amount of cushion when the nozzles (6 pcs) are moved down.

(d) Check if the bottom of the nozzle tip is oblique to the cell. If so, the nozzle position should be adjusted by hand.

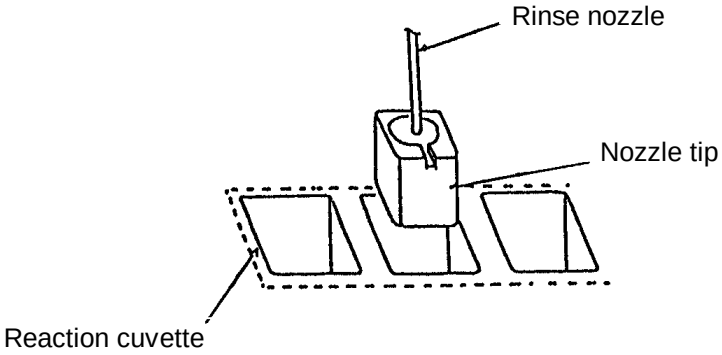


Fig. 12-6 Position of Nozzle of Rinse Mechanism

(4) Check of Rinse Water Volume

(a) Execute "Mechanism Check".

(b) Make sure that no water drops adhere to the top surface of the cell at the time of cell and nozzle wash with the rinse mechanism.

12.10 Operation for Completion and Others

(1) Turn off the power switch, and remove the right cover and circuit board stopper from the inside of the front door of the main unit. Pull out the EMOT200 board and turn off DIP SW 1, no. 6. Return the board to its original condition and turn on the power switch.

(2) Output and analyze accumulated alarm information in Alarm Log Print. Delete alarm information.

(3) Delete the contents of request on the Calibration Registration screen.

(4) Delete all data for routine samples on the Monitor screen.

(5) Make final check of the instrument (attachment of covers, tightening of screws, etc.).

(6) Turn off the power switch of the instrument and the deionized water supply unit. Also turn off the tap water.

(7) Write the date of takeover on the date label and attach it to the 902 main unit (side for example).

12.11 Install Program

12.11.1 Configuration

Three floppy disks (hereafter referred to as FD) are available .
Detailed below is the file configuration of each FD.

(1) Explanation of File (name and contents of file)

- Installation FD (no. 1)

VOL: None	Contents of file
¥ ECPU230L.TXT	Name of file to be installed
SCRENXXX.M2S	Screen information 1
SCRENXXX.M2T	Screen information 2
SCRENXXX.M2G	Screen information 3
SCRENXXX.M2M	Screen information 4
VXWORKS	Installation program

- Installation FD (no. 2)

VOL: None	Contents of file
¥ VXWORKX1.XXX	Model 902 product program 1
VXWORKX2.XXX	Model 902 product program 2

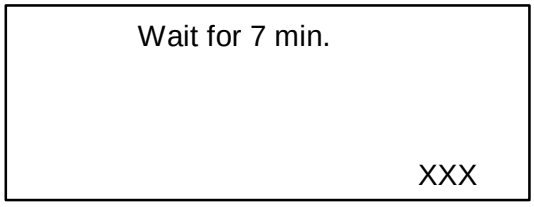
- Installation FD (no. 3)

VOL: None	Contents of file
¥ VXWORKX3.XXX	Model 902 product program 3
TBL_6801.XXX	Model 902 product program 4
TMCLOAD1.XXX	Model 902 product program 5

12.11.2 Procedure for Installation of Product Program

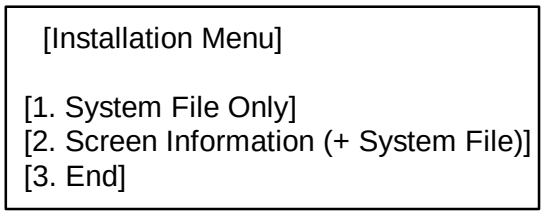
(1) Load the installation FD (no. 1) into drive 1 (left FDD), and turn on the main switch of the instrument.

(2) The screen given below then appears.
(If the screen given below does not appear (if the space screen is displayed), it is necessary to execute installation of screen information (initialization) with reference to 12.12.4.
(If the message "Screen data is destroyed." is displayed, it is necessary to initialize the image memory. Execute initialization of the LCD module memory.)



The program is loaded and the next screen is displayed.

(3) Display of Installation Menu Screen

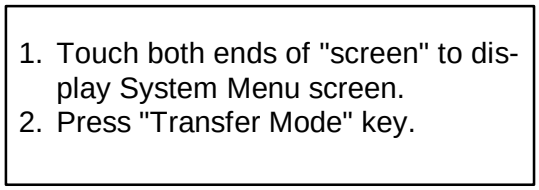


Waiting for Selection of Installation Function

[1. System File Only]	:	Updating of product program alone
[2. Screen Information (+ System File)]	:	Updating of screen information and product program
[3. End]	:	End (suspension of installation)

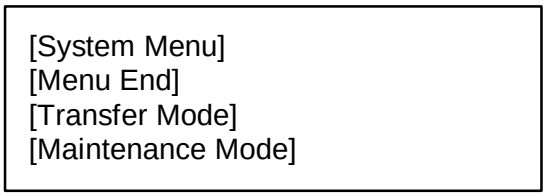
Press the [2. Screen Information (+ System File)] key.
The next screen is displayed.

(4) Installation Instruction Screen



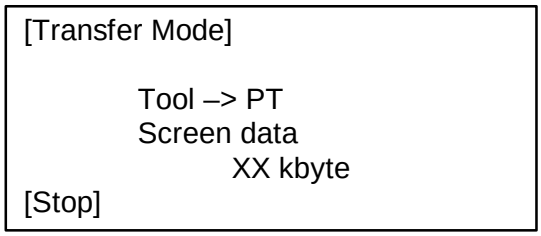
Simultaneously press 2 touch switches at the corners of the screen.
The system menu is displayed. (The next screen appears.)

(5) System Menu Screen



Press [Transfer Mode] key to enter transfer mode.
The next screen is displayed.

(6) Screen Information Transfer Screen

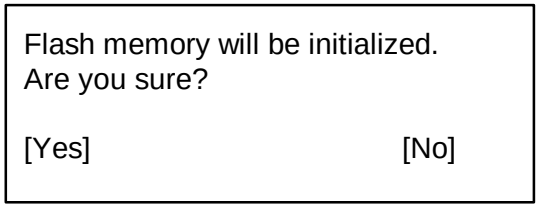


During transfer, the indication of memory capacity changes.
When the memory indication (XX kbyte) is cleared, press [Stop] key.

Note: Do not press the [STOP] key before, or the full installation procedure inclusive 12.11.4 and 12.11.5 will have to be carried out !

The next screen is displayed.

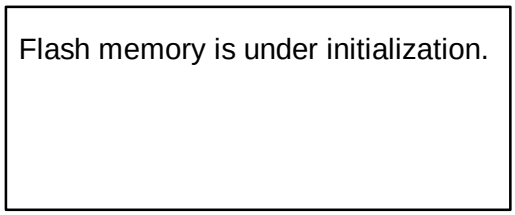
(7) Waiting for Request to Initialize Flash Memory



Waiting for Request to Initialize Flash Memory
[Yes] : Execution of flash memory initialization
[No] : End (suspension of installation)

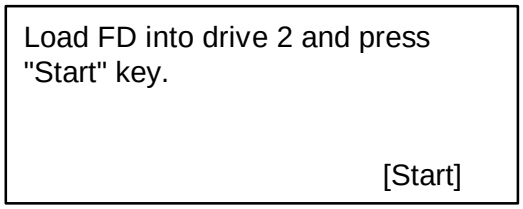
Press [Yes].
The next screen is displayed.

(8) Display of Flash Memory Initialization



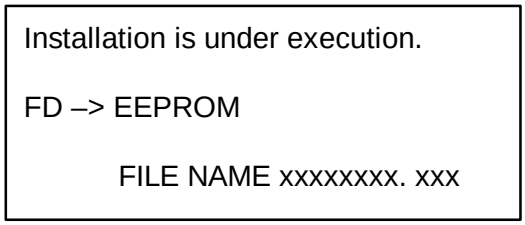
Display of flash memory initialization
Upon completion of initialization, the next screen appears.
(approx. 30 seconds required for initialization)

(9) Display of Installation Start



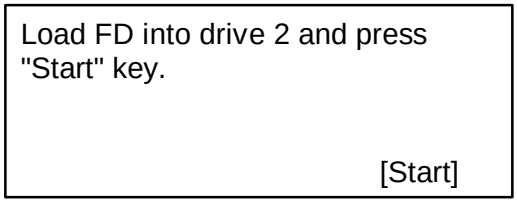
Load the installation FD (no. 2) into FD drive 2 (right FDD), and press [Start] key.
The next screen is displayed.

(10) Installation Display Screen (indicates that product program is under installation)



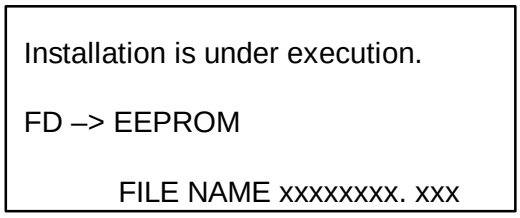
The name of file being installed (xxxxxxxx. xxx) is displayed.
Upon completion of installing all files in the installation FD (no. 2), the following screen is displayed again.

(11) Display of Installation Start



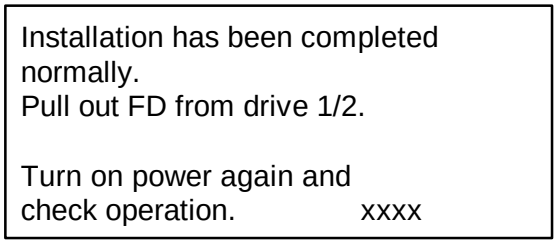
Pull out installation FD (no. 2) from drive 2 (right FDD), load the installation FD (no. 3) into drive 2 (right FDD) and press [Start] key.

(12) Installation Display Screen (indicates that time chart data and program is under installation)



The name of file being installed (xxxxxxxx. xxx) is displayed.
Upon completion of installing all files in the installation FD (no. 3), the following screen is displayed.

(13) Installation End Display Screen



Warning indication (W)	:	Displayed if the number of accesses to EEPROM exceeds 50,000.
SUM value indication (XXXX)	:	Display of SUM value for area installed to EEPROM (Make sure that the displayed SUM value is correct.)

Pull out the FD from drive 1 and drive 2, turn on power again and check operation.

12.11.3 Check Items

After installation, check the following items.

(1) The SUM value on the installation end display screen is as follows.
xxxx OK NG

(2) Upon powering on the instrument, the version of screen information (at lower right of screen) is displayed as follows.
xxx OK NG

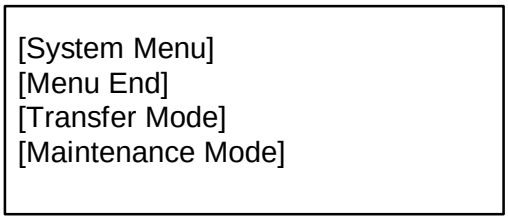
12.11.4 Procedure for Installation of Screen Information (initialization)

(1) Load the installation FD (no. 1) into drive 1 (left FDD), and turn on the main switch of the instrument.

(2) The space screen is presented.

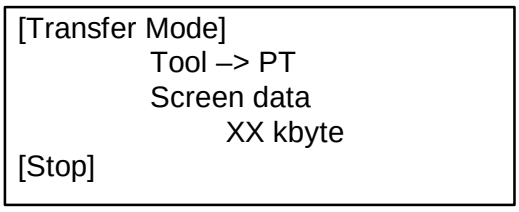
When the program is loaded, "buzzer" sounds.
Simultaneously press 2 touch switches at the corners of the screen. The system menu is displayed. (The next screen is displayed.)

(3) System Menu Screen



Press [Transfer Mode] key to enter transfer mode.
The next screen is displayed.

(4) Screen Information Transfer Screen

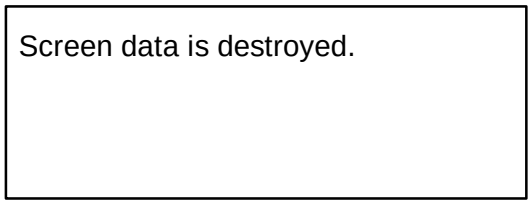


The indication of memory capacity changes during transfer.
When the memory indication (XX kbyte) is cleared, press [Stop] key.

After that, perform step no. 7 and subsequent of the procedure for installation of the product program.

In case of a failure in screen information transfer, the next screen is displayed.

(5) Screen Displayed in Case of Failure in Screen Information Transfer



Screen information transfer has failed. (Execute installation again.)
After initialization of the LCD module memory (refer to 12.12.5), carry out "Procedure for Installation of Screen Information (installation)" again.

12.11.5 Procedure for Initial Setting of LCD Module

Explained below is initialization of the LCD module memory.

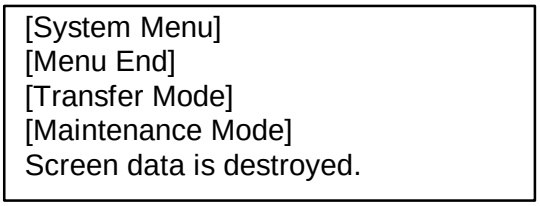
(1) Display of System Menu

Power on the 902 main unit.
When there is no image data, "System Menu" is displayed.
When the operation mode (RUN lamp lit) is set, press the touch switch to display "System Menu".

(2) Initial Screen

Display immediately after turning on power when image data is not registered (space display)

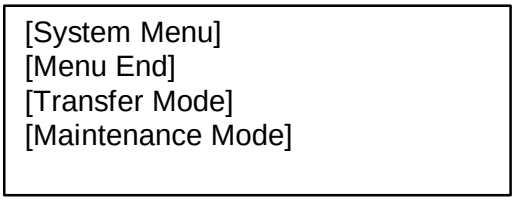
Display immediately after turning on power when image data is destroyed



(3) How to Display System Menu

Upon simultaneously pressing 2 touch switches at the corners of the screen (positions marked "□" below), the system menu is displayed.

(4) System Menu Screen (Execute operation for display of "System Menu" when image data is not registered.)

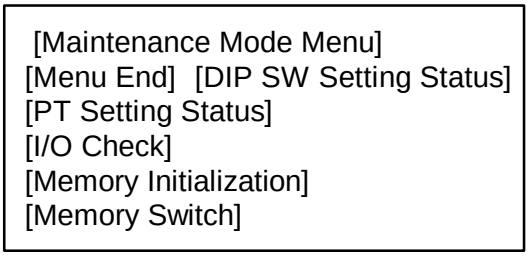


Press [Maintenance Mode] from the system menu to display "Maintenance Mode Menu". The next screen is displayed.

How to Return to Operation Mode

a) Press [Menu End].
b) Avoid touching the screen for 10 seconds or more (avoid pressing the touch switch).

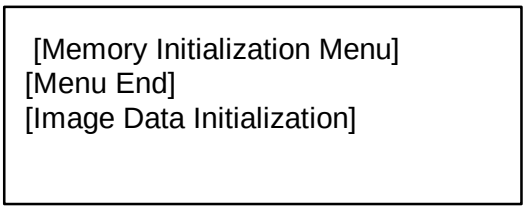
(5) Maintenance Mode Menu Screen



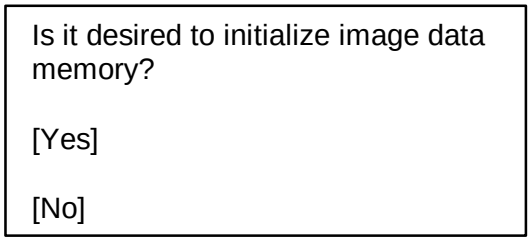
[Memory Switch] : Setting of memory switch
[DIP SW Setting Status] : Confirmation of DIP SW setting status
[Memory Initialization] : Initialization of image data memory

Press [Memory Initialization] key.
The next screen is displayed.

(6) Memory Initialization



Select [Image Data Initialization].

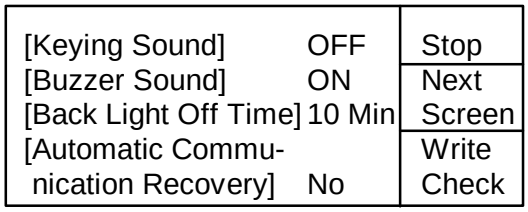


Select [Yes].

The image data memory is initialized.
"Initialization is under execution." is displayed during initialization.

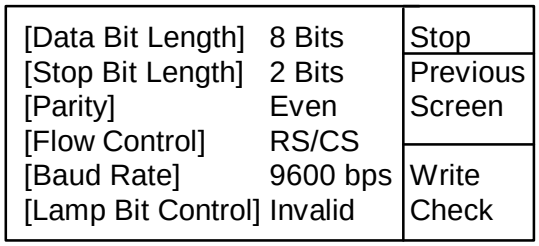
Upon completion of initializing the image data memory, execute installation according to "Procedure for Installation of Product Program".

(7) Memory Switch Setting 1
(**NOTE:** Each switch is set as shown below. Setting change may disable startup of the instrument. So avoid changing the setting.)



Press [Write Check] key.

(8) Memory Switch Setting 2
(**NOTE:** Each switch is set as shown below. Setting change may disable startup of the instrument. So avoid changing the setting.)



Press [Write Check] key.

(9) DIP SW Setting Status Display

```
[DIP SW Setting Status]
1. Forced Data Initialization  No
2. System Message Mode         English
3. System Menu Display         Enable
4. Unused                      OFF
[End]
```

Press [End] key.

13. MAINTENANCE AND INSPECTION

13. Maintenance and Inspection 13-1

13. MAINTENANCE AND INSPECTION

Periodic Cleaning/Inspection and Periodic Parts Replacement List for Model 902 Automatic Analyzer

○: Periodic inspection/cleaning ●: Periodic replacement part △: Consumable part □: Maintenance part

No.	Item	Part No.	Q'ty Required Every Time	Q'ty Required Every Year	Frequency							Consumable Part	Maintenance Part	Remarks
					Every Day	On Occasion	Every Week	Every Month	Every 3 Months	Every 6 Months	Every Year			
1	Sample cup	F611049			○	●						△		
2	Sample probe	713-0201			○								□	
3	Reagent probe	713-0202			○								□	
4	Nozzle seal	F729051				* ●							□	
5	Reaction cuvette (18 pcs contained)	713-0282	6	72				●					□	
6	Incubation bath and incubation bath discharge filter	707-0433							○				□	
7	Light source lamp (20 W)	705-0840	1	2						* ●			□	
8	Printer paper	16F-6042			○							△		
9	Stirring rod	713-1264			○									
10	Seal piece (for sample pipetter)	714-0853	1	4	○				●				□	714-1360, 714-1282, 714-1361
11	Seal piece (for reagent pipetter)	714	2	8	○				●				□	714-1362, 714-1291, 714-1363
12	O-ring (for pipetter)	704-0409			○				●				□	
13	Water supply filter	305-2626						○					□	
14	Radiator filter	713-1316						○					□	
15	HITERGENT	986-8010				●						△	□	
16	HIALKALI D	987-0126					○					△	□	
17	Diaphragm	707-1803											□	
18	Floppy disk (MF2-250HD)	R629134											□	
19	Light source lamp (30 W)												□	
20	Taper syringe	G825045											□	For reagent pipetter
21	Nozzle 1 (for rinsing)	707-0204			○								□	
22	Nozzle 2 (for blank water)	707-0205			○								□	
23	Nozzle 3 (for aspiration)	707-0206			○								□	
24	Nozzle 4 (with tip, for aspiration)	713-0290			○								□	
25	Nozzle 5 (rinsing bath)	713-1078			○								□	
26	Nozzle 6 (with tip, for aspiration)	713-1081			○								□	
27	Nozzle tip (with tip, for aspiration)	F729050			○							△	□	
28	NYLATCH G	707-1337											□	
29	NYLATCH P	707-1336											□	
30	Spring	L913590											□	
31	Spring stopper	707-1088											□	
32	Cleaning wire (1 to 6)	705-0516											□	
33	Taper Syringe	713-1331											□	For sample pipetter

14. ADJUSTMENT SPECIFICATIONS

14.1 Electrical Adjustments 14-1
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- 14.1.2 LOG AMP Board Adjustment 14-2
- 14.1.3 ADC Timing Adjustment 14-3
- 14.1.4 Reaction Bath Temperature Adjustment 14-3
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14. ADJUSTMENT SPECIFICATIONS

14.1 Electrical Adjustments

14.1.1 DC Power Supply Adjustment and Checks

Carry out adjustment and checks of the power voltages shown in Table 14-1.

Table 14-1 Analyzer DC Power Supply Adjustment/Check Specifications

Voltage(V)	Adjustment/Check	Voltage Measuring Position	Adjusting Trimmer
5	Adjust to 5.35 ± 0.05 V	5 V power output terminal	5 V power trimmer
12 (lamp)	Adjust to 12.3 ± 0.05 V	12 V power output terminal	12 V power trimmer
15	Check -15 ± 0.8 V	TP6-TP5 on DIP board	–
-15	Check -15 ± 0.8 V	TP7-TP5 on DIP board	–
24	Adjust to 24.3 ± 0.1 V	24 V power output terminal	24 V power trimmer

14.1.2 LOG AMP Board Adjustment

Adjust the LOG AMP board at the rear of instrument in the procedure below. The standard lamp should be used for this.

< Adjusting procedure >

(1) After turning on the instrument, wait for at least 30 minutes (for the lamp to stabilize).

(2) Make sure there is water in the reaction bath, and carry out the following adjustments.

(3) Check if voltage is 2.00 ± 0.005 V across check pins TP20-TP15 (G). If not, adjust it with trimmer VR14.

(4) Check if voltage is 6.00 ± 0.005 V across check pins TP21-TP15 (G). If not, adjust it with trimmer VR13.

(5) Flip toggle switch SW3 upward, and adjust trimmers VR1 to VR12 to obtain 1.81 ± 0.05 V across check pins TP14-TP15 (G) at positions 0 to B of rotary code switch SW1.
Table 14-2 shows the settings of rotary code switches SW1 and SW2 and the trimmers to be used for adjustment.

(6) When adjustment with trimmers is finished, set rotary switches SW1 and SW2 to "F" and flip the toggle switch SW3 downward.

Table 14-2 SW1/SW2 Settings and Corresponding Trimmers

Wavelength No.	SW1 Setting	SW2 Setting	Adjusting Trimmer
1	0	0	VR1
2	1	1	VR2
3	2	2	VR3
4	3	3	VR4
5	4	4	VR5
6	5	5	VR6
7	6	6	VR7
8	7	7	VR8
9	8	8	VR9
10	9	9	VR10
11	A	A	VR11
12	B	B	VR12

14.1.3 ADC Timing Adjustment

Adjust the ADC timing in the following procedure.

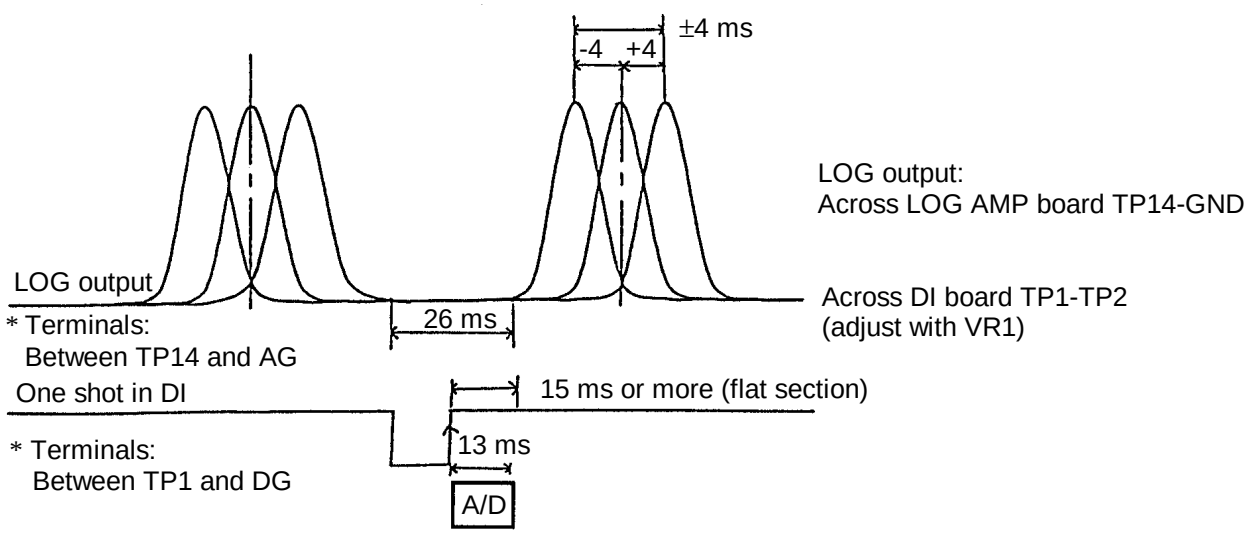
< Adjusting procedure >

The board to be adjusted is the DI board (1st board from the right in circuit board rack).

(1) Measure voltage across check pins TP1-TP2 (G) (DI board) and across TP14-GND (LOG AMP board) using a synchroscope.

(2) Rotate the reaction disk using the mechanism check operation of the instrument check program, and adjust the measured waveform using trimmer VR1 to obtain the timing shown in Fig. 14-1.

NOTE: It may take 1 or 2 minutes until the LOG AMP output waveform appears.



In AD converting operation, a time period of 13 ms is taken from the rise of ADC start signal. This period of time should correspond to the flat section of LOG output.

Fig. 14-1 ADC Timing Waveform Specification

14.1.4 Reaction Bath Temperature Adjustment

Adjust reaction bath temperature in the following procedure.

< Adjusting procedure >

(1) Connect a tester across CP5 and SG of EMIO100 board.

(2) Turn power on and put the instrument in standby.

(3) Adjust VR4 on EMIO100 board so reaction bath water temperature is 37 ± 0.1°C. (Since the heater is turned ON/OFF at around 6.0 V, the tester output should be about 6.0 V when reaction bath water temperature is 37°C.)

(4) Adjust the reaction bath temperature indication with VR3.

NOTE: A YSI thermometer should be used to measure the reaction bath water temperature.

NOTE: The measuring position for the YSI thermometer is midway between the sample discharge position and reagent discharge position.

14.1.5 Barcode Reader Switch Setting

Set and/or check the DIP switches of the barcode reader in the following procedure.
In case of sample barcode reader: Use the settings made by the manufacturer.
Details of setting are given in Table 14-3.

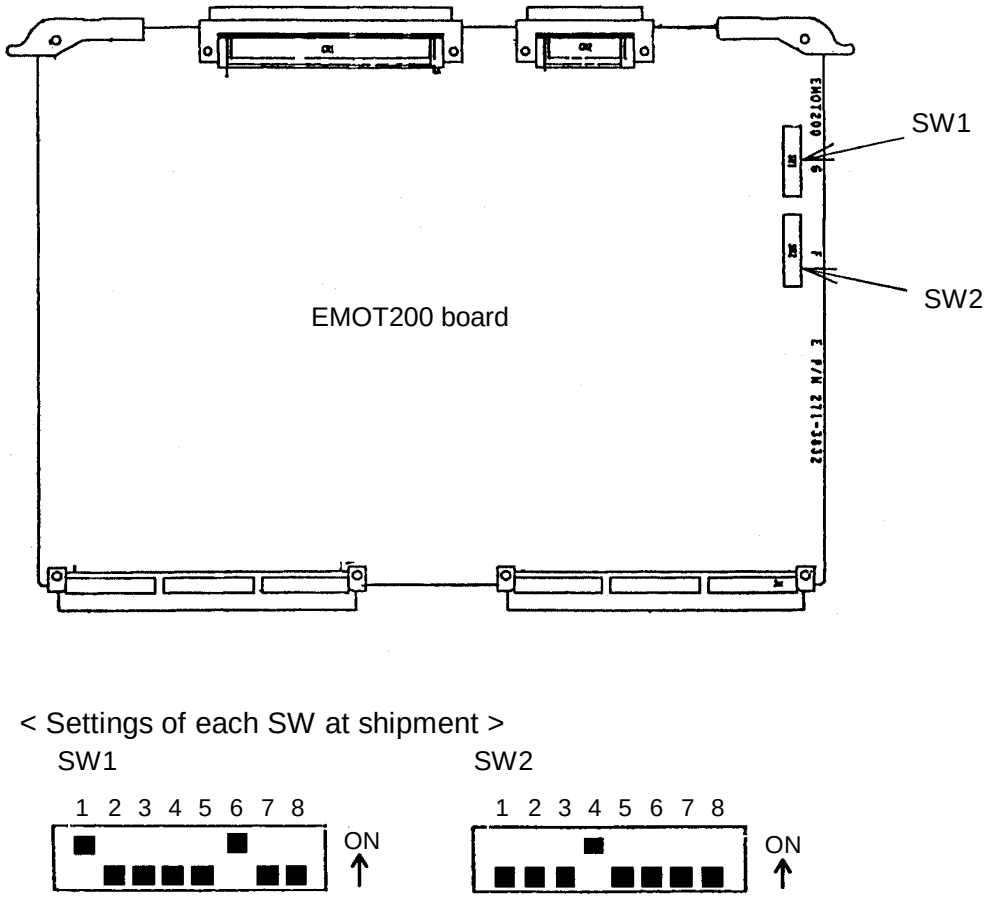


Fig. 14-2 Barcode Reader DIP Switch Settings

Table 14-3 Barcode Settings

Readable Barcodes		ITF, CODE 39, NW-7 (Modulas 10, Modulas 16), CODE 128
Check digit with/without	NW-7	MOD10/MOD16/Without
	CODE 39	With/Without
	ITF	With/Without
	Code 128	With
No. of digits read		Variable length
Signal line monitoring		Yes
INZONE signal		Yes
Communication speed		9600 bps
Frame configuration		7 bits, even parity, 1 stop bit
Data format		ETX
Readout system		CCD

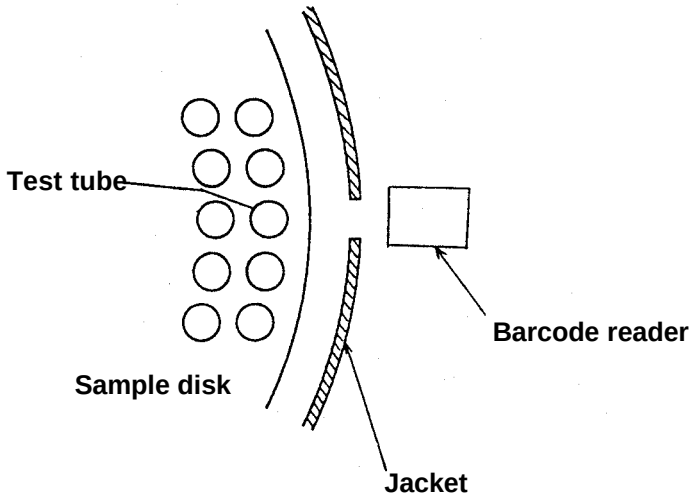
14.1.6 Barcode Reader Positioning

Position the barcode reader in the following procedure.

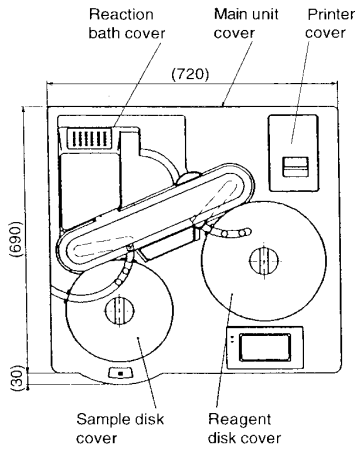
< Positioning procedure >

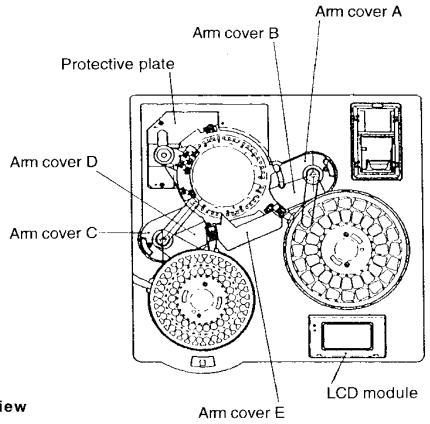
- Check of disk stopping position
  Make sure the sample disk stopping position is aligned with the cutout in the jacket.

  NOTE: Do not shift the disk stopping position when positioning the sample probe. And absolutely avoid changing the disk stopping position. Make sure the cutout in the jacket comes to the center of the test tube.

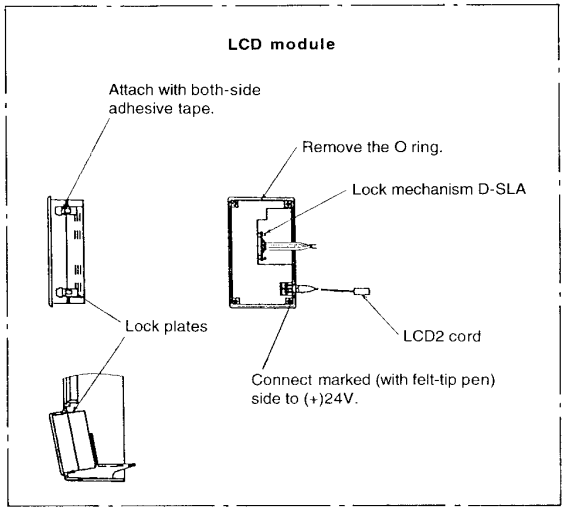


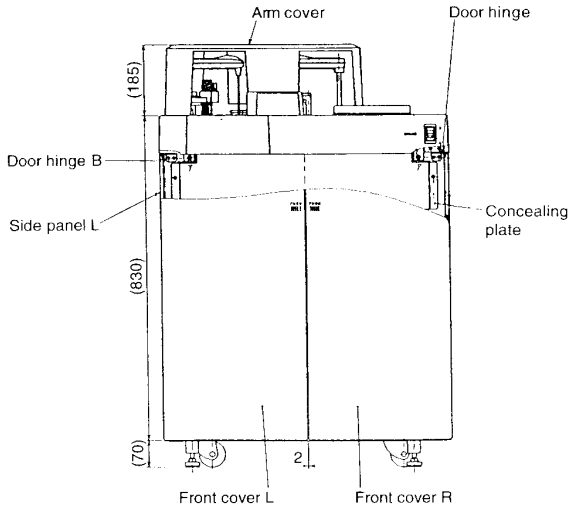
14.2 Adjustment/Disassembly/Reassembly of Mechanisms



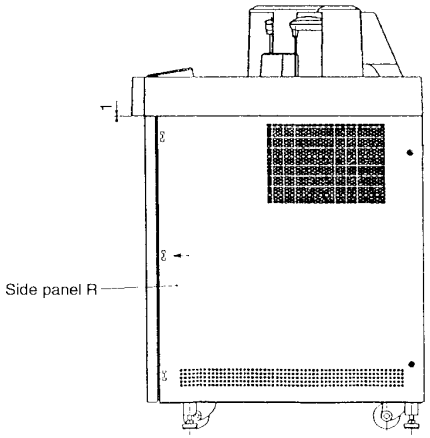


Top view

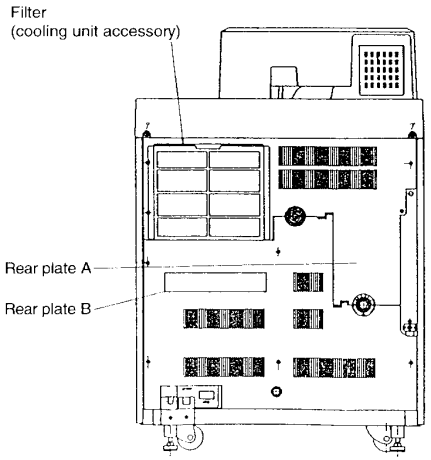




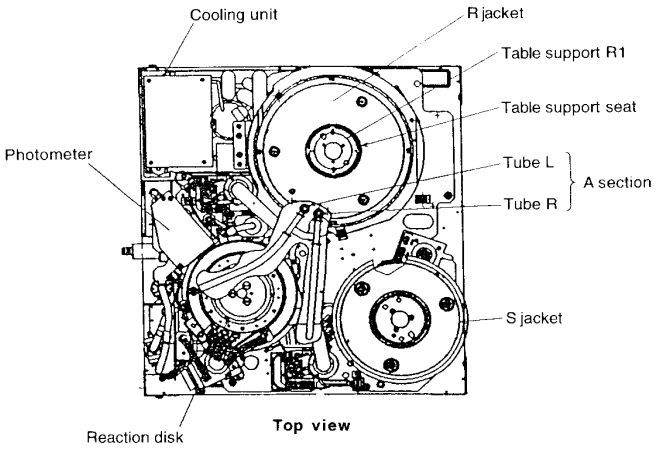
Front view



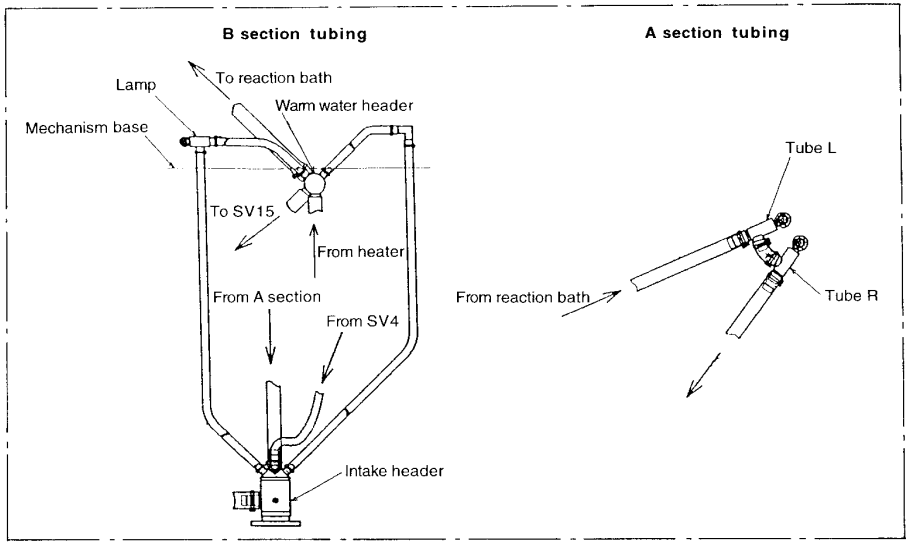
Right side view

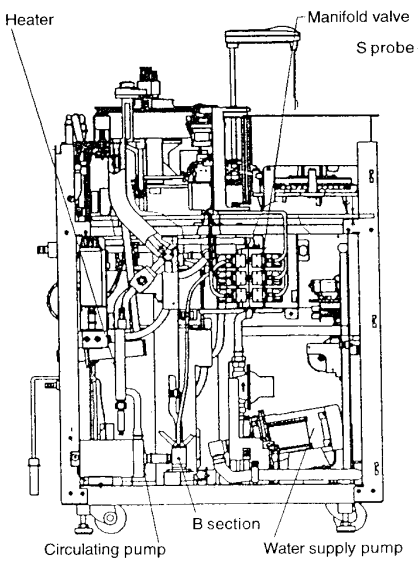


Rear view

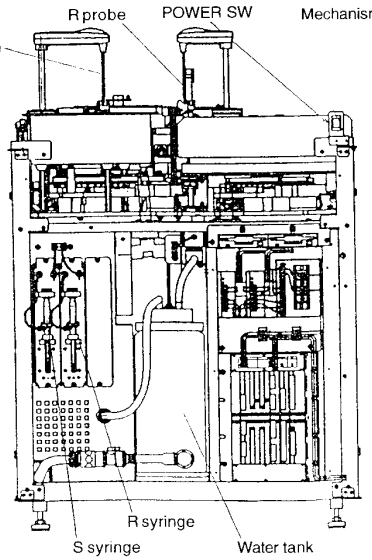


Top view

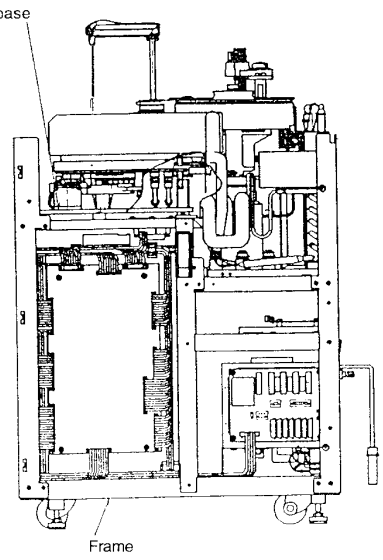




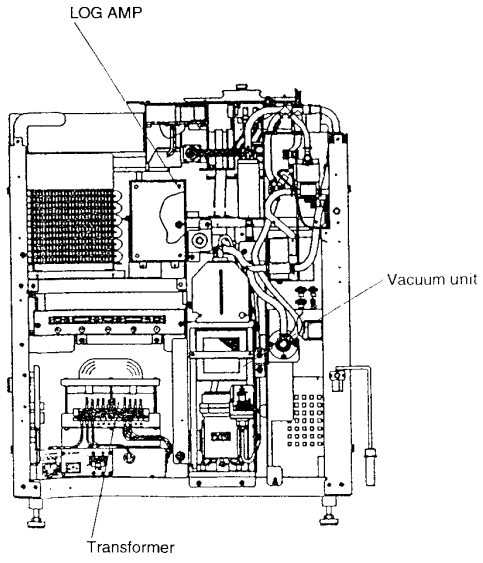
Left side view



Front view



Right side view



Rear view

14.2.1 LCD Touch Panel

(1) Open the front covers L and R and remove the concealing plate at the top front.

(2) Reaching through the opening provided by removing the above plate, apply a blade-edged screwdriver to the claw holding the LCD touch panel from the rear of the main unit cover, and lift up to remove the LCD touch panel.

(3) Detach the power terminal and signal cable connectors from the rear of the LCD touch panel, and remove the touch panel.

< Replacement of backlight on LCD touch panel >

(1) Remove the LCD touch panel.

(2) Open the screw-fastened lid on the 24 V DC terminals at the rear of LCD touch panel.

(3) Detach connector CN2 at the rear of the opening in the lid, remove the backlight and replace it.

14.2.2 How to Remove Main Unit Top Cover

(1) Remove arm covers A, B, C, D and E and the protective plate.

(2) Remove LCD touch panel and the printer unit.

(3) Detach the LED board wiring connector from the main unit cover.

(4) Lift up and remove the main unit cover.

14.2.3 Sample Arm Unit

(1) Remove the main unit cover.

(2) Detach the sample arm tube from the joint of the seesaw mechanism.

(3) Detach connectors J540 and J541.

(4) Remove the grounding wire.

(5) Remove the retaining screws and detach the unit.

14.2.4 Reagent Arm Unit

(1) Remove the main unit cover.

(2) Detach the reagent arm unit tube (passing beneath the reaction bath) from the joint of the seesaw mechanism.

(3) Detach connectors J550 and J551.

(4) Remove the grounding wire.

(5) Remove the retaining screws and detach the unit.

14.2.5 Stirring Mechanism

(1) Remove the main unit cover.

(2) Remove the reagent arm unit.

(3) Detach the stirring mechanism retaining screws and pull out the mechanism, then remove connectors J560 and J561.

14.2.6 Sample Disk

(1) Remove the main unit cover.

(2) Remove the sample disk support (a round plate).

(3) Remove the S jacket.

(4) Remove connectors J510 and J511.

(5) Detach the retaining screws and remove the disk.

14.2.7 Reagent Disk (cooling unit)

(1) Open the side panel L, and drain water manually from the circulating pump intake header.

(2) Remove the main unit cover.

(3) Remove the table support R1.

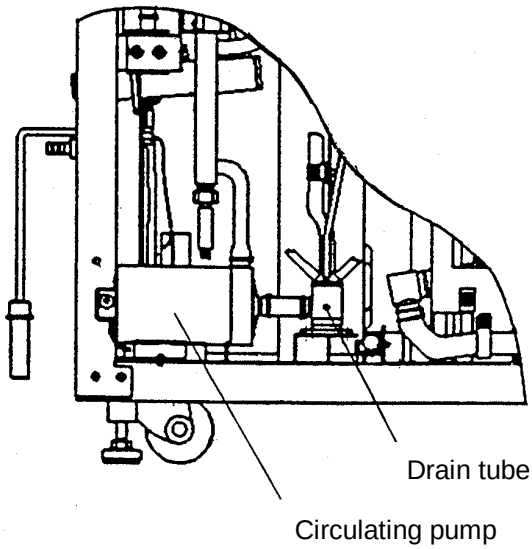
(4) Remove the reagent jacket retaining screws.

(5) Open rear plates A, B and side panel R, and remove cooling unit retaining screws and connectors.

(6) While lifting the reagent jacket, remove tubes L and R from the reaction bath, then detach the cooling unit.

(7) Remove connectors J520 and J521.

(8) Detach the retaining screws and remove the disk.



14.2.8 Reaction Bath

(1) Open side panel L, and drain water manually from the circulating pump intake header.

(2) Remove the main unit cover.

(3) Remove the rinse mechanism for sample, reagent and stirrer.

(4) Remove the reaction bath water level sensor.

(5) Detach retaining screws and remove the bath.

14.2.9 Rinse Mechanism

(1) Remove the main unit cover.

(2) Detach the thumbscrew and remove the rinse mechanism arm section.

(3) Remove connectors J530 and J531.

(4) Detach retaining screws and remove the mechanism.

14.2.10 FDD

(1) Detach retaining screws on the FDD front panel and pull out the FDD carefully.

(2) Detach the connector at the rear of FDD, remove the FDD and replace it.

14.2.11 DC Power Unit

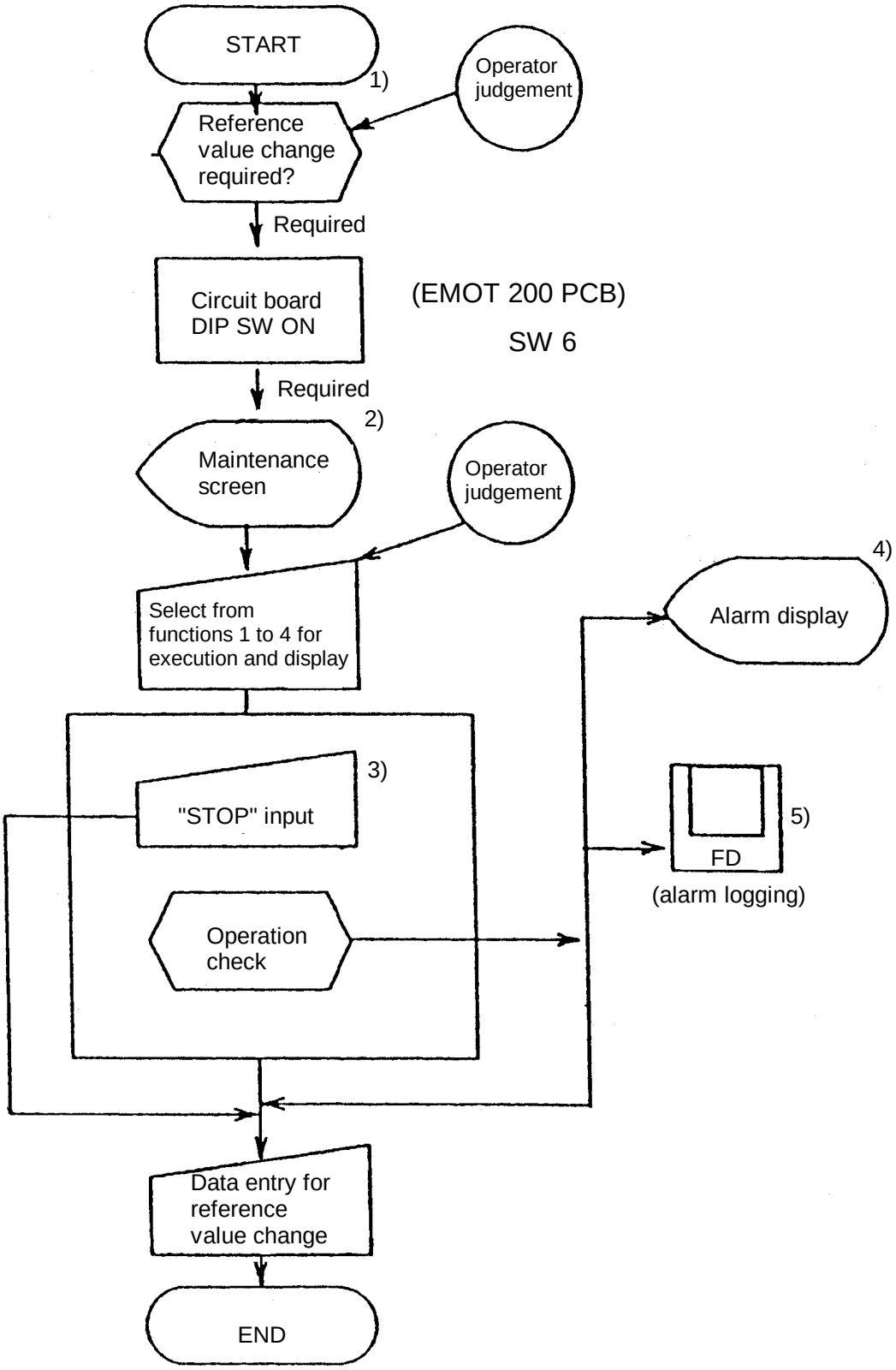
(1) Remove the front right-side cover.

(2) Open side panel R, and remove connector J300 on DRV board.

(3) Reaching through the opening in the right side, remove two connectors at the rear of DC power unit.

(4) Detach retaining screws at the front of DC power unit, and pull the unit forward. Removing the front connector wiring of FDD and circuit board rack will make it easier to pull out the unit.

14.2.12 Probe Adjustment



(1) Functions

1. Adjust stopping position of S.probe rotation.
2. Adjust cup height for S.probe descent.
3. Adjust stopping position of R.probe rotation.
4. Adjust stopping position for stirring rod rotation.
5. Adjust R.probe descent to bottle position.

Required time: Unlimited

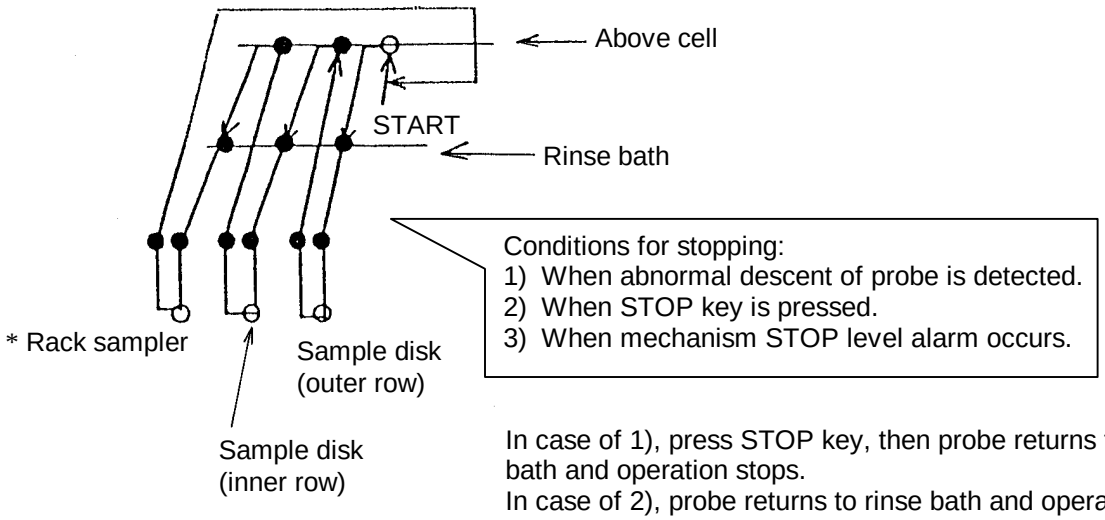
Process No.	Details	Reference Document
1)	Turn ON circuit board DIP SW, and reference value change data area will appear on Probe Adjust screen.	Screen spec., circuit board DIP SW spec.
2)	Start from Maintenance screen. PROBE ADJUST: 1 = S.probe rotation adjustment 2 = Adjustment of cup height for S.probe descent 3 = R.probe rotation adjustment 4 = Stirring rod rotation adjustment 5 = Adjustment of R.probe descent to bottle position	Screen spec.
3)	Refer to next page.	
4)	Check operation at probe adjustment. If operation is not normal, alarm will appear on Alarm Monitor screen.	Screen spec., alarm code table
5)	Save the above alarm in FD.	

(2) Details of Probe Adjusting Process

For the probe adjustment, first reset the mechanisms, then carry out the following procedures.

Adjustment of stopping position of S.probe rotation:

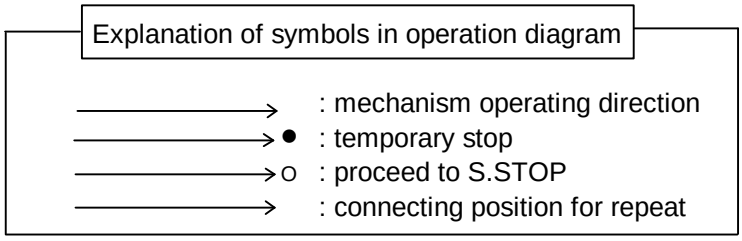
(a) Details of operation


Above cell
START
Rinse bath
Conditions for stopping:
1) When abnormal descent of probe is detected.
2) When STOP key is pressed.
3) When mechanism STOP level alarm occurs.
* Rack sampler
Sample disk
(outer row)
Sample disk
(inner row)
In case of 1), press STOP key, then probe returns to rinse bath and operation stops.
In case of 2), probe returns to rinse bath and operation stops.

(b) Extent of operation

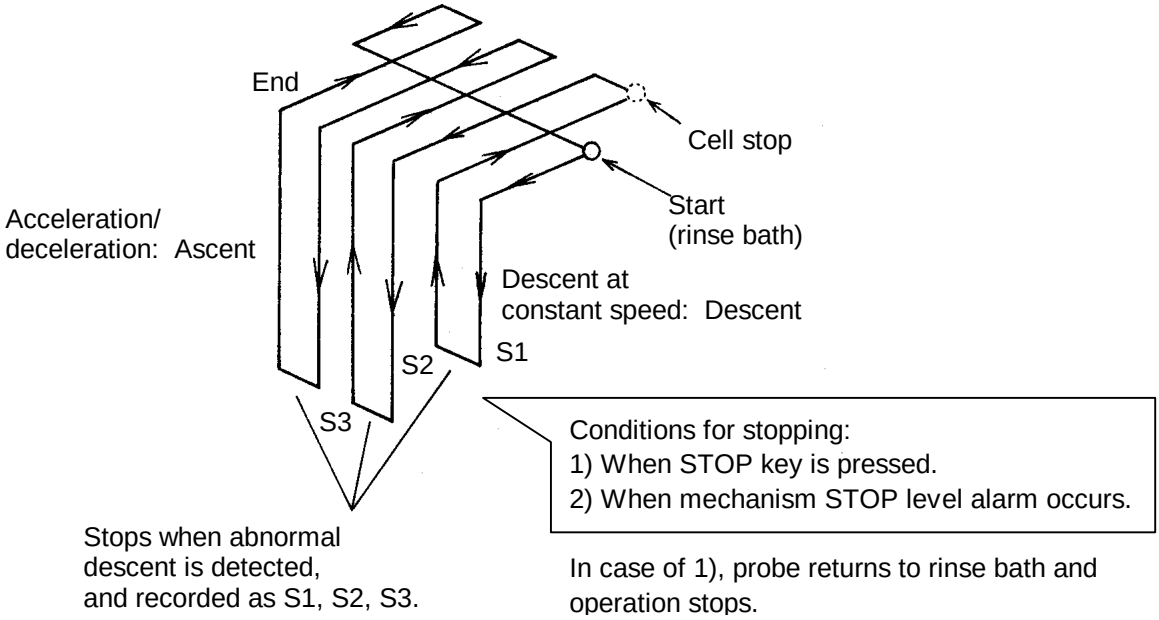
1) Rotation angle: Reference value (no. of pulses) is subjected to no. of correction pulses set on System Parameters screen, and corrected pulse count shall be used.
2) Descent amount: Sample disk (inner/outer rows); H_1 - 5 mm
H_1 is no. of descent pulses given in 2-2.

* When rack sampler is provided.


Explanation of symbols in operation diagram
: mechanism operating direction
: temporary stop
: proceed to S.STOP
: connecting position for repeat

Adjustment of cup height for S.probe descent:

(a) Details of operation



NOTE: Does not advance when S.STOP key pressed.

Probe descent position:
S1 -- sample disk outer row No. 1 position (empty sample cup)
S2 -- sample disk outer row No. 2 position (empty sample cup set on ø16 mm × 100 mm test tube)
S3 -- sample disk inner row W1 position (empty sample cup)

(valid only for pos. 58, 59, 60)

Above positions are predetermined. Operator must set cups at 3 positions before the adjustment.

(b) Extent of operation

1) Rotation angle : Reference value (pulse count) is subjected to no. of correction pulses set on System Parameters screen, and corrected pulse count shall be used.
2) Descent amount : Should descend to lowermost point (117 mm) at constant speed.

(3) Stroke Identification for Sample Container

S1: Height identification of standard cup on sample disk outer row (No. 1 position)
S2: Height identification of cup on test tube/ same as for S1 (No. 2 position)
} Sample containers *1
S3: Height identification of standard cup on sample disk inner row (W1 position) ..... STD/CONT

*1 Test tubes are settable only on the outer row. Model 902 allows height identification for two kinds of sample containers.

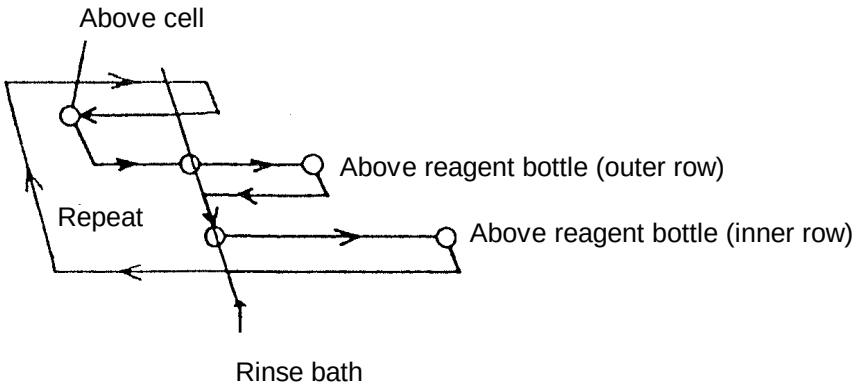
(4) Setting of Sample Containers at S.probe Adjustment *2

Container Used / Set Position	Cup-on-tube	Standard Cup	Test Tube	Standard Cup/Test Tube	Standard Cup/ Cup-on-tube	Test Tube/ Cup-on-tube
S1	Standard cup	Standard cup	Test tube	Standard cup	Standard cup	Test tube
S2	Cup-on-tube	Standard cup/ cup-on-tube	Test tube	Test tube	Cup-on-tube	Cup-on-tube
S3 (W1)	Standard cup	Standard cup	Standard cup	Standard cup	Standard cup	Standard cup

*2 After S.probe readjustment, check if the stroke down to the sample container has changed.

(5) R.probe Rotation Adjustment

(a) Details of operation



Probe is not moved vertically.

(b) Extent of operation

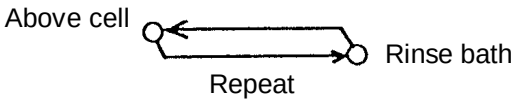
1) Rotation angle: Reference value (pulse count) is subjected to no. of correction pulses set on System Parameters screen, and corrected pulse count shall be used.

Conditions for stopping
1) When STOP key is pressed.
2) When mechanism STOP level alarm occurs.

In case of 1), probe returns to rinse bath and stops.

(6) Stirring Rod Rotation Adjustment

(a) Details of operation



Stirring mechanism is not moved vertically.

(b) Extent of operation

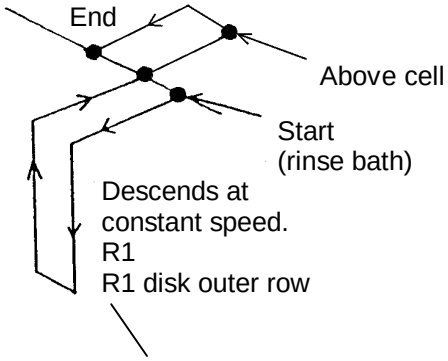
1) Rotation angle: Same as in operation.

Conditions for stopping:
1) When STOP key is pressed.
2) When mechanism STOP level alarm occurs.

In case of 1), rod returns to rinse bath and stops.

(7) Adjustment of R.probe Descent to Bottle Position

(a) Details of operation



Conditions for stopping:
When mechanism STOP level alarm occurs.

Stop operation at abnormal descent, and record height of R1.
(Produce a STOP level alarm. And display it on Maintenance screen.)
Displayed height is value (descent pulses +7) converted to mm (0.07501 mm/pulse).

Probe descent position is predetermined at No. 1 position on outer row.
Operator must pull out bottle.

(b) Extent of operation

1) Rotation angle : Reference value (pulse count) is subjected to no. of correction pulses set on System Parameters screen, and corrected pulse count shall be used.
2) Descent amount : Should descend to lowermost point (114.0 mm) at constant speed.

15. OEM

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15.7 Mark Card Reader ..... (Described on separate sheet)

15. OEM

15.1 DC Power Supply

15.1.1 5 V DC Power Supply

< Specifications >

(1) Type: EWS50-5

(2) Input conditions

(a)	Voltage	:	85 to 265 V AC or 110 to 330 V DC
(b)	Current	:	1.2 A (100 V AC input, under full load), 0.6 A (200 V AC input, under full load)
(c)	Efficiency	:	75% (at maximum output power)
(d)	Rush current	:	6.8 A (100 V AC input), 13.5 A (200 V AC input)
(e)	Frequency	:	47 to 440 Hz

(3) Output characteristics

(a)	Rated voltage	:	5 V
(b)	Maximum output current	:	10.0 A
(c)	Maximum output power	:	50.0 W
(d)	Input fluctuation	:	20 mV
(e)	Load fluctuation	:	40 mV
(f)	Voltage variable range	:	±10%

(4) Protection circuit

(a)	Overcurrent protection	:	Activated at 10.5 A, and auto resetting
(b)	Overvoltage protection	:	Activated at 5.75 to 6.75 V

(5) Environment

(a)	Operating temperature and humidity	:	0 to 50°C, 30 to 90% RH (without condensation)
(b)	Storage temperature and humidity	:	-30 to 85°C, 10 to 95% RH (without condensation)
(c)	Vibration resistance	:	2 G or less (10 to 55 Hz, 2 G constant, in each of X, Y and Z directions for 1 hour)
(d)	Shock resistance	:	20 G or less

15.1.2 24 V DC Power Supply

< Specifications >

(1)	Type	:	EWS300-24
(2)	Input conditions		
	(a) Voltage	:	85 to 132 V AC or 170 to 265 V DC
	(b) Current	:	7.0 A (100 V AC input, under full load), 3.5 A (200 V AC input, under full load)
	(c) Efficiency	:	82% (at maximum output power)
	(d) Rush current	:	25 A (100 V AC input), 50 A (200 V AC input)
	(e) Frequency	:	47 to 440 Hz
(3)	Output characteristics		
	(a) Rated voltage	:	24 V
	(b) Maximum output current	:	14 A
	(c) Maximum output power	:	336 W
	(d) Input fluctuation	:	96 mV (maximum input to minimum input)
	(e) Load fluctuation	:	144 mV (no load to full load)
	(f) Voltage variable range	:	±20%
(4)	Protection circuit		
	(a) Overcurrent protection	:	Activated at 14.7 to 18.2 A, and auto resetting
	(b) Overvoltage protection	:	Activated at 30.0 to 34.8 V
(5)	Environment		
	(a) Operating temperature and humidity	:	0 to 50°C, 30 to 90% RH (without condensation)
	(b) Storage temperature and humidity	:	-30 to 85°C, 10 to 95% RH (without condensation)
	(c) Vibration resistance	:	2 G or less (10 to 55 Hz, 2 G constant, in each of X, Y and Z directions for 1 hour)
	(d) Shock resistance	:	20 G or less

15.1.3 12 V Power Supply

< Specifications >

(1)	Type	:	EWS50-12
(2)	Input conditions		
	(a) Voltage	:	85 to 165 V AC (continuous input system)
	(b) Current	:	1.2 A (100 V AC input, under full load), 0.6 A (200 V AC input, under full load)
	(c) Efficiency	:	74% (at maximum output power)
	(d) Rush current	:	6.8 A (100 V AC input), 13.5 A (200 V AC input)
	(e) Frequency	:	47 to 440 Hz
(3)	Output characteristics		
	(a) Rated voltage	:	12 V
	(b) Maximum output current	:	4.4 A
	(c) Maximum output power	:	52.8 W
	(d) Input fluctuation	:	48 mV (maximum input to minimum input)
	(e) Load fluctuation	:	100 mV (no load to full load)
	(f) Voltage variable range	:	±10%
(4)	Protection circuit		
	(a) Overcurrent protection	:	Activated at 4.6 A or more and auto resetting
	(b) Overvoltage protection	:	Activated at 13.8 to 16.2 V
(5)	Environment		
	(a) Operating temperature and humidity	:	0 to 50°C, 30 to 90% RH (without condensation)
	(b) Storage temperature and humidity	:	-30 to 85°C, 10 to 95% RH (without condensation)
	(c) Vibration resistance	:	2 G or less (10 to 55 Hz, 2 G constant, in each of X, Y and Z directions for 1 hour)
	(d) Shock resistance	:	20 G or less

15.2 Reagent Refrigerator

15.2.1 Function

This unit is used for the Model 902 automatic analyzer and has the following functions.

(a) Keeping analytical reagents cool
(b) Cooling of water circulated in incubation bath

15.2.2 Specifications of Cooling Unit

(1) Refrigerating system
Refrigeration cycle with enclosed type air compressor
The air compressor 2T2B3R126A-1A made by Matsushita is employed.

(2) Dimensions and shape
External dimensions:
Depth (563) × width (346) × height (336) mm (including coolant bath)
Depth (250) × width (225) × height (270) mm (excluding coolant bath)

15.2.3 Specifications of Electrical Components

(1) Power relay

Type	:	G7L-1A-TJ
Rated voltage	:	12 V DC
Rated current	:	158 mA

(2) Operation capacitor

Electrolytic capacitor	:	210 V/20 μF JSU21 × 206AQC

(3) Overload relay

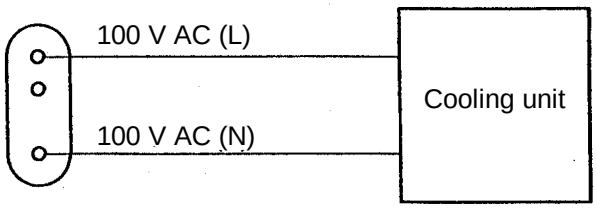
Type	:	MRA98929
Minimum operation current	:	8 A

(4) Fan motor for capacitor

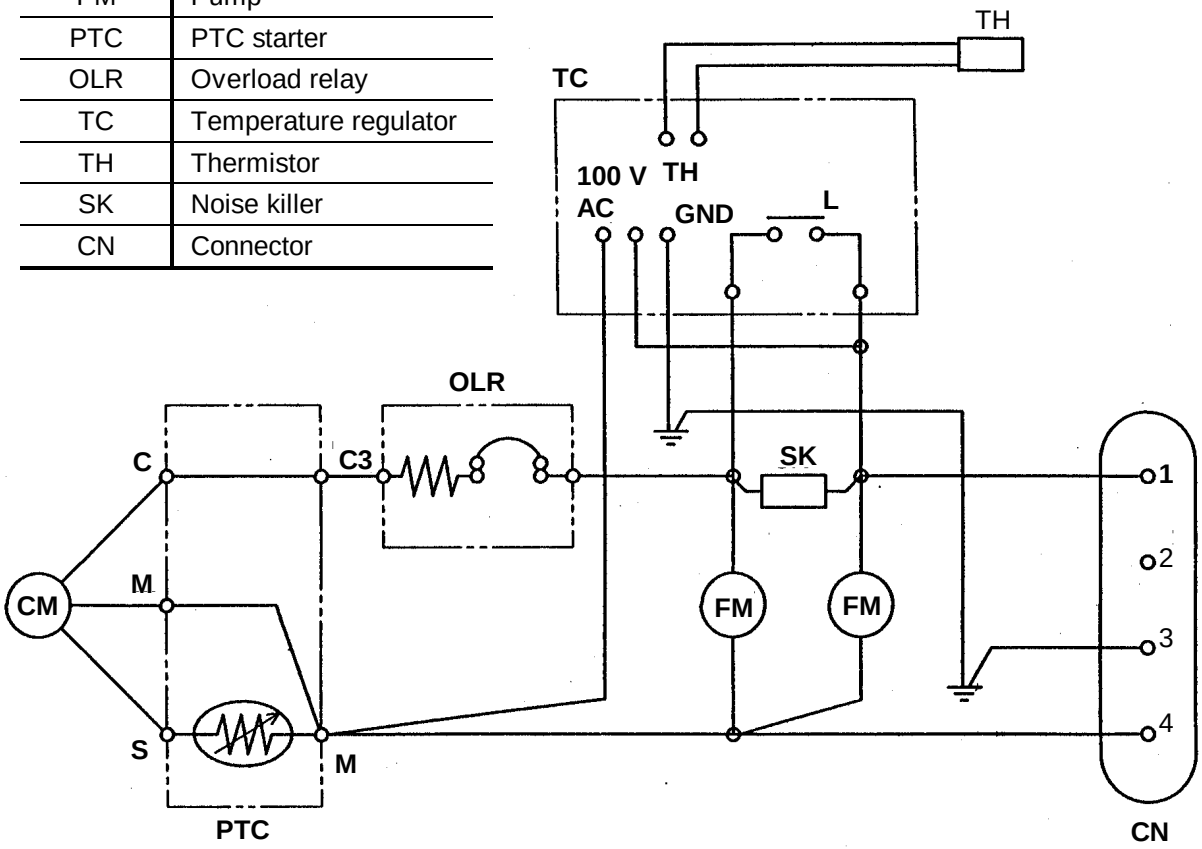
Type	:	PA2H3

AC fan, 115 V AC, 15 W, 2 poles, class E

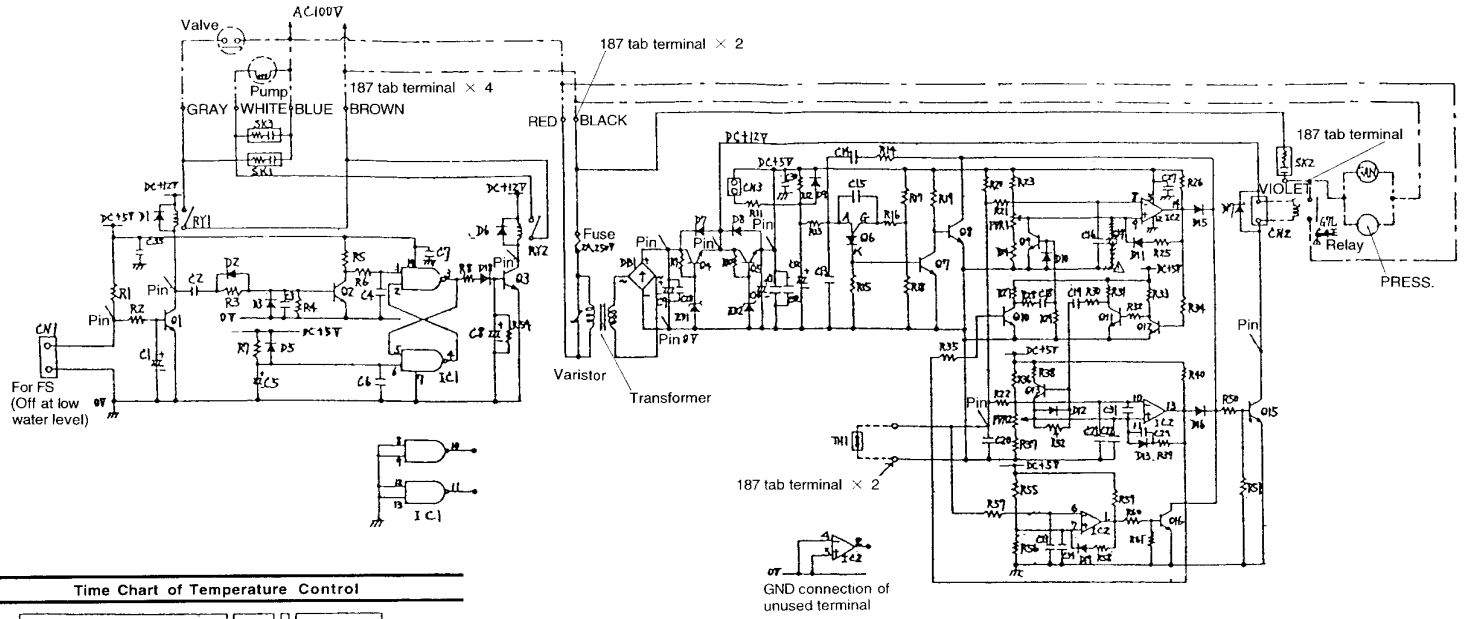
15.2.4 Refrigerator Wiring Diagram

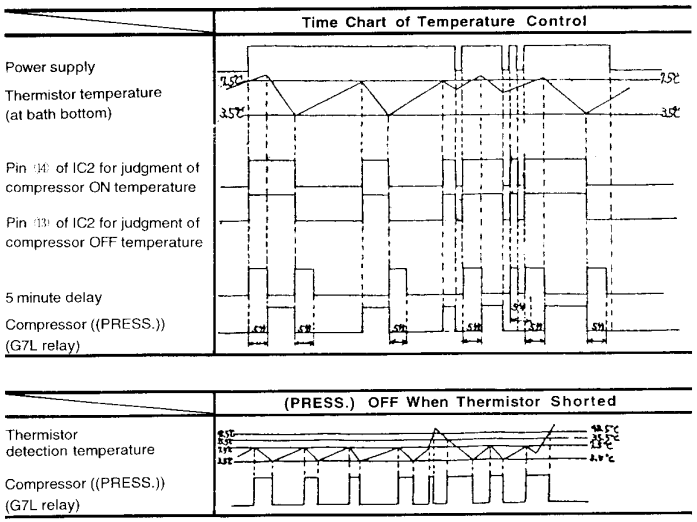


Symbol	Part Name
CM	Refrigerator
FM	Fan motor
PM	Pump
PTC	PTC starter
OLR	Overload relay
TC	Temperature regulator
TH	Thermistor
SK	Noise killer
CN	Connector



15.2.5 Circuit Diagram of Refrigerator Control Circuit




Time Chart of Temperature Control
Power supply
Thermistor temperature (at bath bottom)
Pin (14) of IC2 for judgment of compressor ON temperature
Pin (13) of IC2 for judgment of compressor OFF temperature
5 minute delay
Compressor ((PRESS.)) (G7L relay)

15.3 FDD (YD-702D-6539D-021051)

15.3.1 Specifications

Item	2.0 MB Mode
Recording capacity • When unformatted • When formatted 256 bytes/Sector 512 bytes/Sector 1024 bytes/Sector	 2.0 Mbytes Capacity: Number of sectors 1474.6 kbytes : 18
Recording density	17434 bits/inch
Track density	135 tracks/inch
Total number of cylinders	80 cylinders
Total number of tracks	160 tracks
Recording method	MFM
Recording medium	2HD
Rotational speed	300 r/min
Data transfer speed	500 kbits/s
Mean rotation wait time	100 ms
Access time • Mean access time • Track-to-track transition time • Settling time • Turnaround time	 94 ms 3 ms 15 ms 4 ms
Motor start time (max.)	0.5 s

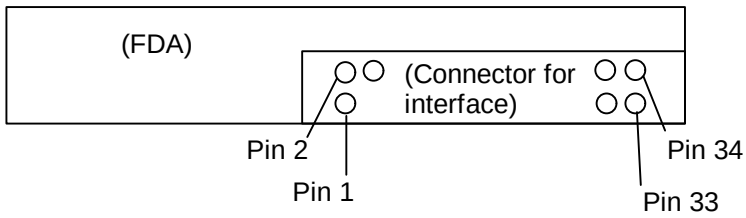
15.3.2 Interface

Connector Pin Arrangement for Interface

Return Pin No.	Signal Pin No.	Signal Name
1	2	MODE SELECT
(3)	4	N.C.
5	6	N.C.
7	8	INDEX
9	10	DRIVE SELECT 0
11	12	DRIVE SELECT 1
13	14	N.C.
15	16	MOTOR ON
17	18	DIRECTION SELECT
19	20	STEP
21	22	WRITE DATA
23	24	WRITE GATE
25	26	TRACK 00
27	28	WRITE PROTECT
29	30	READ DATA
31	32	SIDE ONE SELECT
33	34	READY

NOTE: (3) indicates a key pin.

Connector Pin Arrangement for Interface

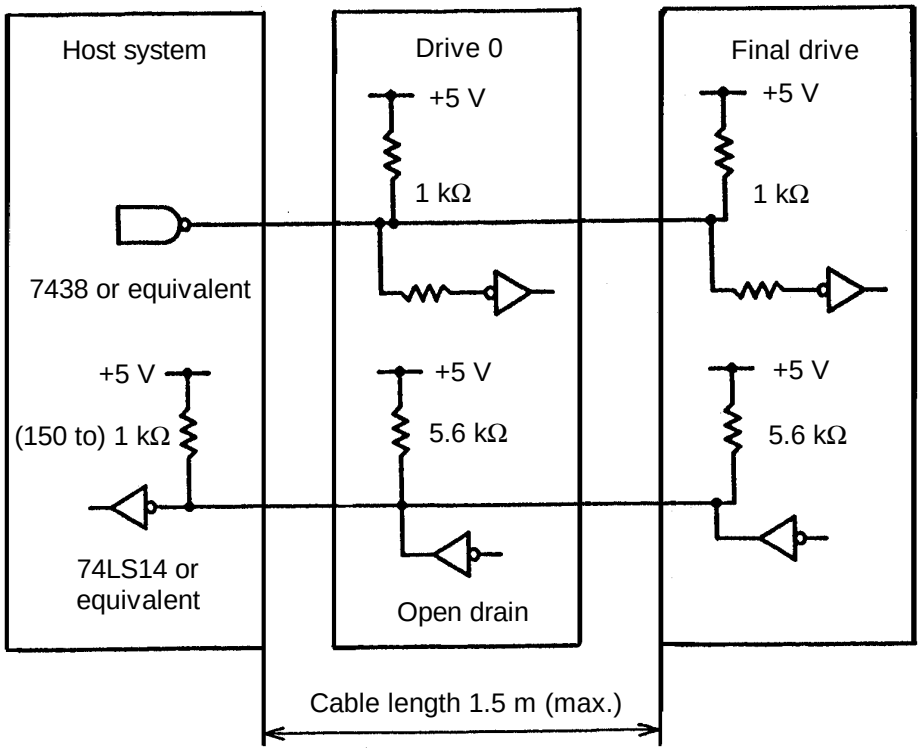


Connector Pin Arrangement for DC Power Supply

Pin No.	Power Supply Specification
1	+5 V
2	+5 V RETURN
3	+5 V RETURN
4	NON CONNECTION

15.3.3 Electrical Specifications (F/D interface signal)

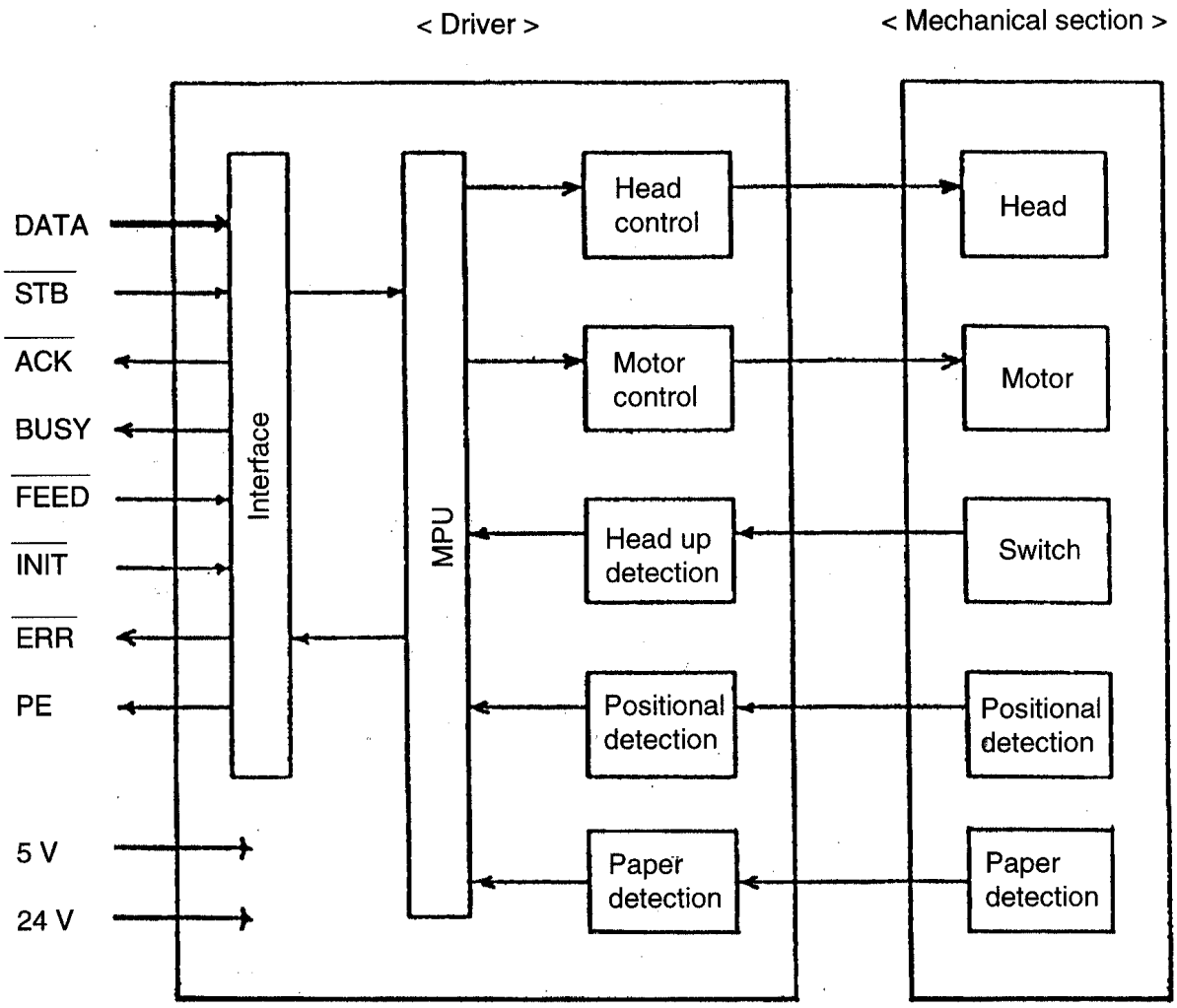
F/D Interface Driver/receiver



15.4 Printer (FTP-020UCS530-#01A)

15.4.1 Configuration

This printer consists of mechanical section and driver.



15.4.2 Specifications

(1)	Printing system	:	Thermal line-dot system
(2)	Dot formation	:	140 line-dots
(3)	Dot pitch	:	2.8 dots/mm (70 dots/inch, in column direction)
(4)	Number of printing columns	:	20 columns (in character mode)
(5)	Character size	:	1.8 (W) × 3 (H) mm.....Normal size (character mode) 3.6 (W) × 3 (H) mm.....Enlarged size (character mode)
(6)	Printing position	:	See Fig. 10.
(7)	Printing speed	:	4 lines/sec (80 characters/sec); Normal size ——┐—Character mode (40 characters/sec); Enlarged size ——┘ 46-dot line/sec ——————————Graphic mode
(8)	Character composition	:	5 × 7 dots ———————————— Character mode 8 × 17 dots/line———————————— Graphic mode
(9)	Character type	:	JIS C II (160 types)
(10)	Printing lifetime	:	2 million lines (20 million-dot lines) or more
(11)	Printing density	:	OD level 0.8 or more (when printing on specified paper at room temperature and drive input voltage 24.7 V)

15.4.3 Interface

(1) System : Conforming with Centronics standards (8-bit parallel)

(2) Transmission speed : 1000 cps——————————— Character mode
2000 bps (bytes/second) ——— Graphic mode

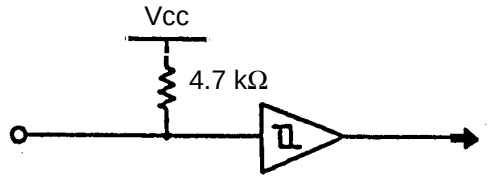
(3) Sync system : Externally fed strobe pulse

(4) Handshaking : $\overline{\text{ACK}}$/BUSY signal

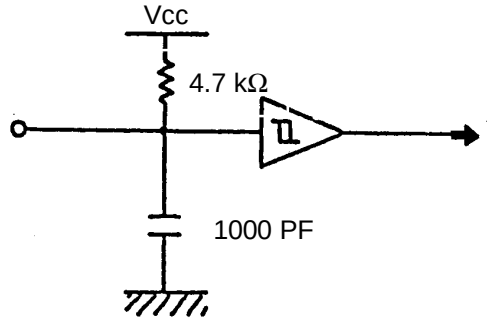
(5) Input/output level : TTL level

(6) Input/output conditions

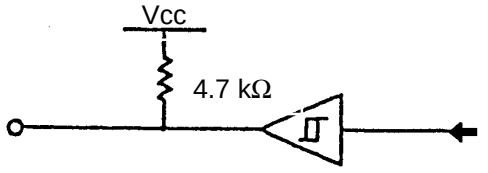
- DATA 1 to 8, $\overline{\text{FEED}}$, $\overline{\text{INIT}}$



- $\overline{\text{STB}}$



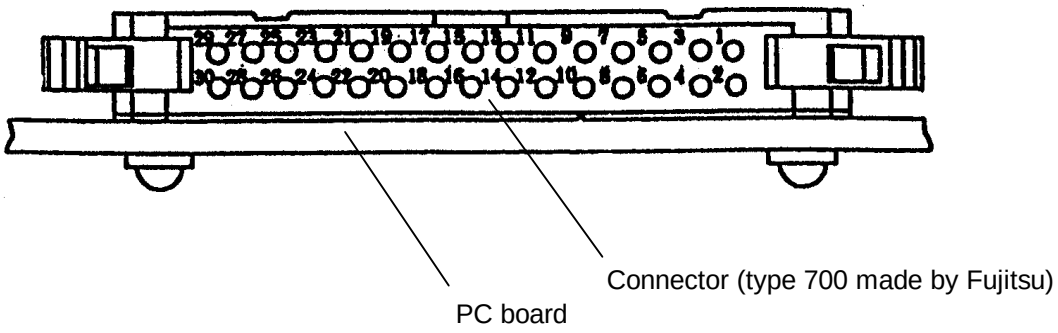
- BUSY, $\overline{\text{ACK}}$, PE, $\overline{\text{ERROR}}$



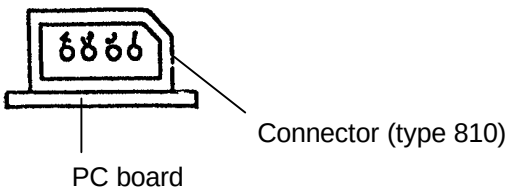
NOTE: Both Fanin and Fanout are set to "1", 74LS or equivalent is connected on the host side and a pull-up resistor (4.7 kΩ) is provided in the final stage.

15.4.4 Connectors

Pin No.	Signal Name	Pin No.	Signal Name
1	$\overline{\text{STB}}$	2	GND
3	DATA 1	4	GND
5	DATA 2	6	GND
7	DATA 3	8	GND
9	DATA 4	10	GND
11	DATA 5	12	GND
13	DATA 6	14	GND
15	DATA 7	16	GND
17	DATA 8	18	GND
19	$\overline{\text{ACK}}$	20	GND
21	BUSY	22	GND
23	PE	24	GND
25	+5 V	26	$\overline{\text{INIT}}$
27	NC	28	$\overline{\text{ERROR}}$
29	$\overline{\text{FEED}}$	30	GND



- **Power Connector**



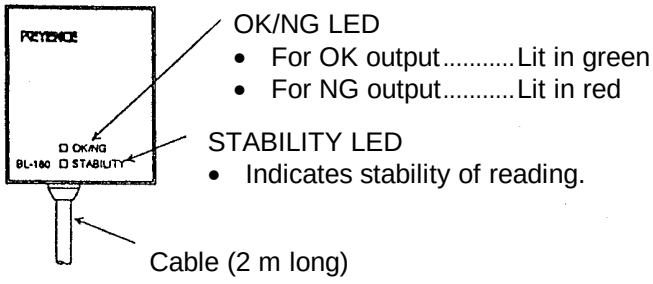
Pin No.	Description	Cable Color
1	5 (V)	Red
2	GND	Black
3	GND	Black
4	24 (V)	Orange

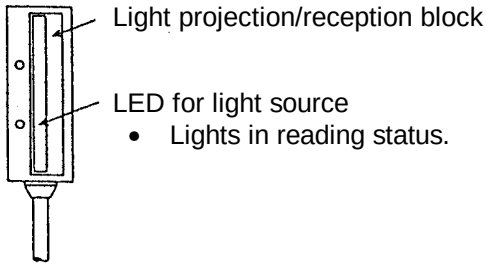
15.5 Barcode Reader (CCD system)

15.5.1 Specifications

Type		BL-180
Reading direction		Front type
Light source and light receiving element		LED and CCD image sensors
Reading distance		33 mm ± 10 mm (for narrow width 0.19 mm or more)
Reading bar width		0.125 to 1.0 mm
Maximum readable label width		80 mm (for narrow width 0.19 mm or more)
PCS value		0.45 or more (reflectance of white 75% or more)
Scan frequency		500 scans/sec
Compatible code		CODE 39, ITF, INDUSTRIAL 2 OF 5, COOP 2 OF 5, NW-7, CODE 128, JAN/EAN/UPC (A·E)
Number of reading digits		32 digits max.
Timing input		No-voltage input (with/without contact) * TTL input allowed
OK/NG output	Output form	NPN open collector
	Rated load	24 V DC, 100 mA
	Leakage current at OFF	0.1 mA or less
	Residual voltage at ON	0.5 V or less
Serial interface	Standard	Conformity with EIA RS-232C
	Synchronizing method	Asynchronous
	Transmission code	ASCII
	Baudrate	600 to 38,400 bits/s
	Data length	7 or 8 bits
	Parity check	No, even or odd
	Stop bit length	1 or 2 bits
Environmental conditions	Operating illuminance	Daylight or incandescent lamp: 10,000 lx, Fluorescent lamp: 3,000 lx
	Operating temperature	0 to 40°C
	Operating humidity	35 to 85% RH (without condensation)
	Operating atmosphere	Excessive dust and corrosive gas unallowable
	Vibration resistance	10 to 55 Hz, double amplitude 1.5 mm, in each of X, Y and Z directions for 2 hours
	Insulation resistance	100 MΩ or more between power terminal and case (when measured with 500 V DC megger)
	Dielectric strength	1,000 V AC for 1 minute between power terminal and case
Ratings	Power voltage	5 V DC ± 5%
	Current dissipation	300 mA
Weight		Approx. 165 g

Name of Each Part





15.6 LCD Touch Panel

15.6.1 Specifications

Item	Specifications
Rated power supply voltage	24 V DC
Permissible power supply voltage range	20.4 to 26.4 V DC (24 V DC -15%, +10%)
Power consumption	10 W or less
Operating temperature	0 to 50°C
Operating humidity	35 to 85% RH or less, without condensation
Operating atmosphere	Corrosive gas unallowable
External dimensions	190 (W) × 110 (H) × 58 (D) mm
Weight	0.7 kg or less

- **Specifications of Display Section**

Item	Specifications	
STN dot matrix liquid crystal display panel	Number of dots (resolution)	128 × 256 dots (0.407 mm square)
	Effective display area	56 × 112 mm
	Angle of visibility	±35° in left-right direction
	Service life	50,000 hours or longer
Back light (white cold cathode ray tube)	Service life	Guaranteed for 10,000 hours (average 20,000 hours)
	Automatic turn-off function	10 min, 1 hr or none
Indication LED	POWER (green)	Lit with power supply turned on
	RUN (green)	Lit during operation

- **Specifications of Operating Section**

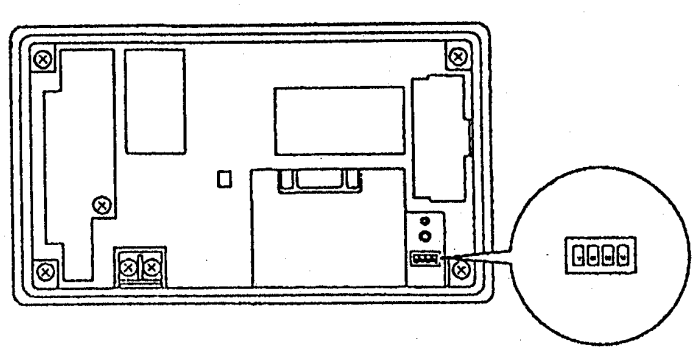
Item	Specifications		
Touch panel	Number of switches	:	Max. 72 switches registrable on one panel (Y6 × X12 switches)
	Input	:	Impact system
	Activation force	:	100 gf or less
	Service life	:	1 million times or more

- **Specifications of Communication**

Item	Specification
Communication standard	EIA RS-232C
Communication parameters	Start-stop synchronization Transmission speed : 2400, 4800, 9600 or 19200 (in bps) Data length : 7 or 8 bits Stop bit : 1 or 2 bits Parity : Even, odd or none Flow control : RS/CS control XON/XOFF control None
Connector	9-pin D-SUB connector (female)
Number of connectable units	One to one
Transmission distance	Max. 15 m

- **Setting of DIP Switch**

The operational status of NT20S is settable by the DIP switch at the bottom right on the rear face of main frame.

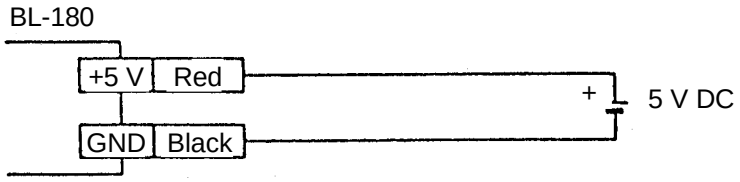


Switch No.	Function		Factory Setting
SW2-1	Validity or invalidity of forced panel data initialization		
	ON	NT20S starts in a special operation mode where only the initialization of panel data memory is carried out. At startup, the memory initialize menu is displayed.	
	[OFF]	NT20S starts in the usual operation mode.	O
SW2-2	Panel display language mode		
	ON	Messages are indicated in English.	
	[OFF]	Messages are indicated in Japanese.	O
SW2-3	Permission or prohibition of transition to system menu		
	ON	System menu cannot be indicated. If an error has occurred at start, the system menu is automatically indicated, but transition to "transmission mode" cannot be made.	O
	[OFF]	System menu can be indicated.	
SW2-4	Unused		
	ON		
	[OFF]		O

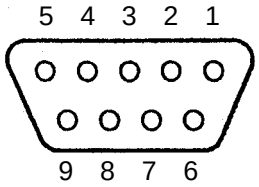
Brackets [ ] indicate the factory setting.

- **Wiring**

Wire Color	Symbol	Description	Signal Direction
Shield	FG	Frame ground	———
Purple	SD (TXD)	RS-232C data transmission	Output
Brown	RD (RXD)	RS-232C data reception	Input
Pink	RS (RTS)	RS-232C request to send	Output
Blue	CS (CTS)	RS-232C clear to send	Input
Black	GND (SG)	Ground (common ground with each signal)	———
Yellow	TIM	Timing input	Input
White	OK	OK output	Output
Gray	NG	NG output	Output
Red	+5 V	+5 V power input	Input



- **Pin Arrangement**



D-sub 9 pins (female)
DTE specifications (terminal definition)
#4-40 screw (male)

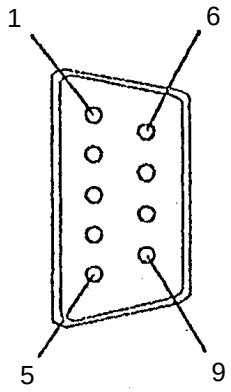
Pin No.	Symbol	Description	Signal Direction
Connector case	FG	Frame ground	———
1	TIM	Timing input	Input
2	RD (RXD)	RS-232C data reception	Input
3	SD (TXD)	RS-232C data transmission	Output
4	OK	OK	Output
5	GND (SG)	Ground (common ground with each signal)	———
6	NG	NG	Output
7	RS (RTS)	RS-232C request to send	Output
8	CS (CTS)	RS-232C clear to send	Input
9	+5 V	+5 V power supply	Input

- **Connecting Procedure**

  Described below is the method of connecting NT20S and host with RS-232C.

< Connector Pin Arrangement of NT20S >

The connector has the following specifications.
- Electrical characteristics: Conform with EIA RS-232C.
- Connection signals : Signal direction is as seen from the host side.



Connector Pin No.	Signal Name	Symbol	Signal Direction	
			Input	Output
1	Protective ground or ground	FG (Note 1)	—	—
2	Transmitted data	SD (TXD)		O
3	Received data	RD (RXD)	O	
4	Request to send	RS (RTS)		O
5	Clear to send	CS (CTS)	O	
9	Signal ground	SG (GND)	—	—

NOTES: 1. FG is not connected inside NT.
2. The pin without entry is not used.

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16. SYSTEM INTERFACE

16.1 Overview

Provided here are the signal form and protocol (communication rules) in case of connection between the Model 902 and an external system (hereafter referred to as a host) via asynchronous serial signal.

(1) Specifications of Communication

The following table lists the specifications of RS-232C communication.

Table 16-1 Specifications of Communication

No.	Item	Specifications	Remarks	Default Value (standard value)
1	Interface	RS-232C or 20 mA current loop	—	—
2	Communication method	Half duplex	—	—
3	Data bit	7 or 8 bits	Communication parameter screen	7 bits
4	Stop bit	1 bit/2 bits		2 bits
5	Parity check	Even/odd/no parity		Even parity
6	Baud rate (bit/sec)	4800/9600 NOTE		9600
7	Max. volume of transferred data	256/512 bytes		256
8	End-of-data code	ETX + BCC/CR + LF + ETX/ETX ETX + CR + LF ETX + CKSH + CKSL + CR		ETX + BCC
9	Code	JIS 7 bits, JIS 8 bits or ASCII	—	
10	Synchronization system	Asynchronous system (Start-stop transmission)	—	
11	Transmission control procedure	Determined by host	—	
12	Number of ports	1 max.	—	
13	Text mode	Nontransparent mode (ASCII)	—	
14	Cable length	15 m max. (RS-232C)	—	

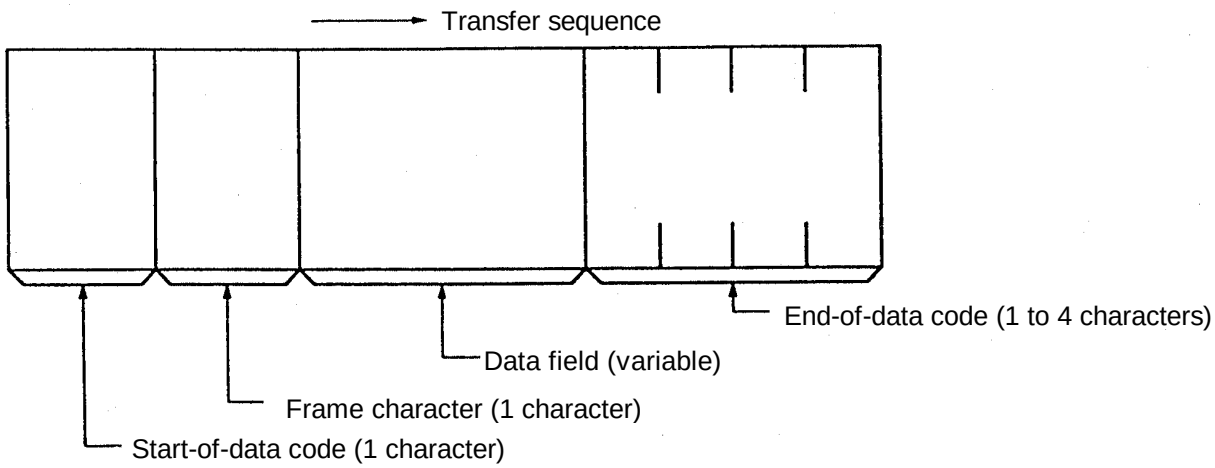
(2) Features

(a) The communication cycle is not synchronized with the analysis cycle. So the analyzer replies upon receiving a response from the host.

(b) The data bit, stop bit, parity check, baud rate, maximum volume of transferred data and end-of-data code are selectable by the user.

(3) Outline of Text

The format of communication text is shown below.



Each block of text is detailed below.

(a) Start-of-data code (1 character)
STX code (ASCII code $02)

(b) Frame character (1 character)
Refer to Table 16-3.

(c) Data field (variable)
(i) When there is no data field (non-specific request text)
There is no data field because MOR, ANY, REP, SUS and REC are control frames.
(ii) When there is a data field (specific request text)
Frames other than in (i) above. The data field includes a function character.

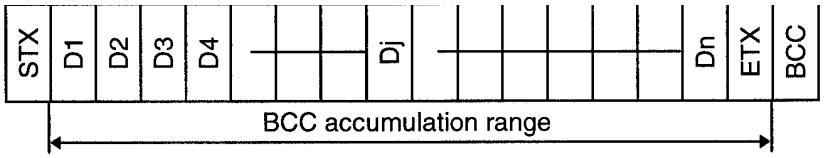
(d) End-of-data code (1 to 4 characters)
Any of the following five combinations is selectable on the host setting screen.
(i) ETX + BCC (NOTE 1) .....(ASCII code $03 + BCC)
(ii) CR + LF + ETX.....(ASCII code $0D + $0A + $03)
(iii) ETX.....(ASCII code $03)
(iv) ETX + CR + LF.....(ASCII code $03 + $0D + $0A)
(v) ETX + CKSH + CKSL (NOTE 2) + CR .....(ASCII code $03 + h + l + $0D)

The text length from (a) to (d) is selectable on the communication parameter screen. (256 or 512 bytes)

NOTES:

1. BCC (Block Check Character)
   The RS-232C communication program is provided with a function to add BCC to the send text and support BCC check of the receive text for detection of an improper message.
   - Condition (1): The start-of-text character is STX $(02)_{16}$ and the end-of-text character is ETX $(03)_{16}$.
   - Condition (2): The text data consists of characters (nontransparent mode).

   At this time, BCC accumulation is started from the character following STX and carried out until ETX appears.

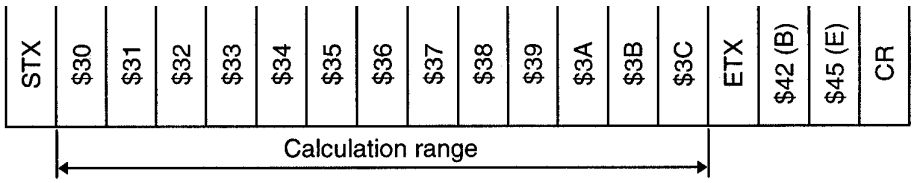


   [Calculation Method]

   Dn = n-th character in hexadecimal notation (1 byte)
   BCC = Block check character (1 byte)
   BCC = D1 + D2 + D3 + Dj + ...Dn + $(ETX)_{16}$
   (+: Exclusive OR)

2. CKSH (checksum high) and CKSL (checksum low)
   The checksum is calculated by adding all characters between the frame character and the final character in the data field (one character before end-of-data code), and the lower two digits of the calculated checksum are converted to the ASCII code.

   Example:



16.2 Communication Functions

(1) Tables 16-2 and 16-3 list the host communication functions provided with the Model 902 Automatic Analyzer.

Table 16-2 Communication Function List for Test Selecting Information

(A): Analyzer side (H): Host side

Function		Inquiry from (A) to (H)	Instruction from (H) to (A)	Conditions
Test selecting information inquiry communication on routine sample	With ID	O	O	Valid when [NO] is specified for the transfer of analytical data alone on the communication parameter screen.
	Without ID	O	O	Same as above
Stat sample	With ID	O	×	Valid when [NO] is specified for the transfer of analytical data alone and [YES] is specified for stat sample test selection.
	Without ID	×	×	

Table 16-3 Communication Function List for Measurement Result Data

Function		Real-time Communi-cation	Batch Communi-cation	Specific Sample Request	Conditions
Measurement result data communication	Routine and stat samples	○	○	○	Specific sample request is invalid when [YES] is specified for the transfer of analytical data alone as a system parameter.
	Control sample	○	○	×	
	Calibration measurement result data	○	×	×	
	Absorbance measurement result data in entire reaction process (original absorbance data)	○	×	×	Valid when [YES] is specified for original absorbance parameter.

○: Executable ×: Inexecutable

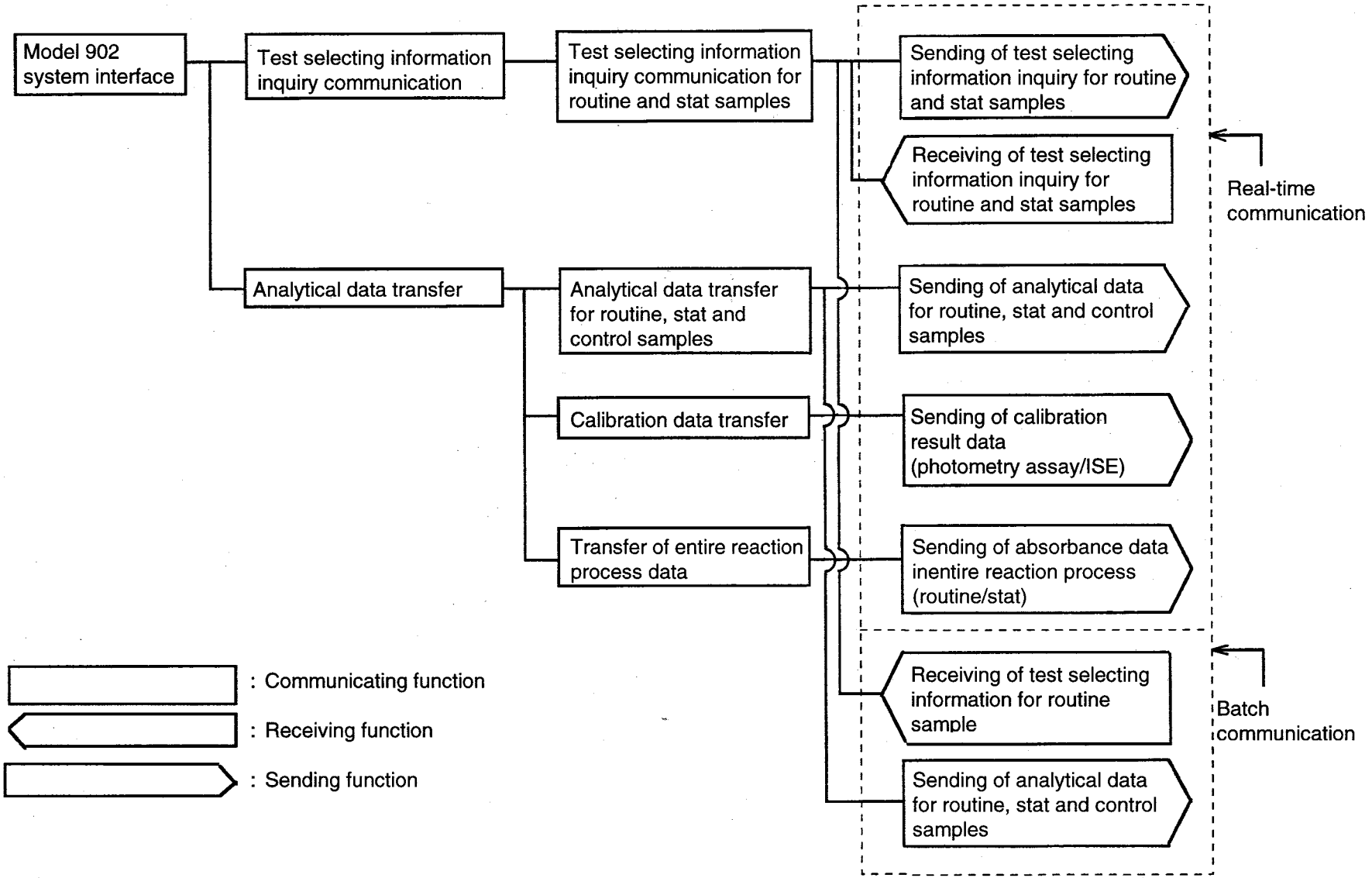
Supplementary Explanation

(a) The above real-time communication indicates a communication carried out while the instrument is engaged in analysis, and the batch communication indicates a communication when specified through the screen.
(Note, however, that test selecting information inquiry is not specifiable through the screen but specifiable only from the host.)

(b) To stop communication between the analyzer and host, change [RUN] (highlighted) to [CANCEL] for host communication on the start condition screen. In this case, however, remember that the entire communication processing will be suspended.

(c) Stat sample test selecting information is specifiable from the host, in response to inquiry from the analyzer during real-time communication. However, an independent specification from the host is invalid.

(2) Functional Relationship with Model 902 System Interface


Model 902 system interface
Test selecting information inquiry communication
Test selecting information inquiry communication for routine and stat samples
Sending of test selecting information inquiry for routine and stat samples
Receiving of test selecting information inquiry for routine and stat samples
Real-time communication
Analytical data transfer
Analytical data transfer for routine, stat and control samples
Sending of analytical data for routine, stat and control samples
Calibration data transfer
Sending of calibration result data (photometry assay/ISE)
Transfer of entire reaction process data
Sending of absorbance data inentire reaction process (routine/stat)
Receiving of test selecting information for routine sample
Batch communication
Sending of analytical data for routine, stat and control samples
: Communicating function
: Receiving function
: Sending function

16.3 Frames

Each frame represents the purpose of a text (contents of message). Table 16-4 lists the frames.

Table 16-4 Frame List

AU: Analyzer side HOST: System side

No.	Mnemonic	Name	Character	ASCII Code	Sender	Meaning		
1	FR1	Frame 1	1	$ 31	AU	For analytical data transfer	Used when send data extends over more than one text. FR1 is used for the first text and END for the final text. End alone is used when analytical data for one sample can be sent in a single text. These frames are used to send analytical data.	
2	FR2	Frame 2	2	$ 32				
3	END	End Frame	:	$ 3A				
4	SPE	Specific Sample	;	$ 3B	AU	TS directive inquiry	Used for TS inquiry for only one specific sample. (TS: Test selecting information)	
					HOST		Used for TS direction from HOST.	HOST uses SPE for TS inquiry using SPE from AU as well.
5	RES	Results Request	<	$ 3C	HOST	Specific sample request	Used to request analytical data of a specific sample from HOST to AU. (Whether ID is provided or not, routine and stat samples alone are taken as valid and the others are ignored.)	
6	ANY	Any inquiry	>	$ 3E	AU	Positive response (corresponding to ACK)	Used by AU to ask HOST for the following items. (1) TS information prosess (2) HOST's initiation of rerun sample (3) RES, REC or MOR frame request	
7	MOR	More			HOST		Means that HOST is ready to receive analytical data. (Analytical data can be transferred from AU to HOST only when HOST has sent this frame.)	
8	REP	Repeat	?	$ 3F	AU, HOST	Negative response (correcponding to NAK)	Used when resending for the previous communication is requested. HOST can send REP at any time, but AU sends it only when the text from HOST is destroyed and resends the same text in any other case.	

(cont'd)

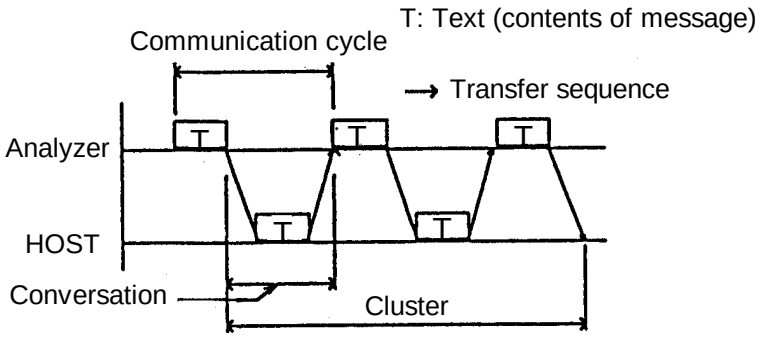
No.	Mnemonic	Name	Character	ASCII Code	Sender	Meaning	
9	SUS	Suspend	@	$ 40	AU, HOST	Suspension request	Sent by AU to suspend resending of a non-specific inquiry and allow a specific inquiry. Sent ty HOST to suspend communication for one communication cycle or longer without recording the last communication by AU.
10	REC	Received	A	$ 41	HOST		Used to request AU to suspend communication for one communication cycle or loner because HOST is not ready to receive any analytical data.

16.4 Data Transmission Control Procedure

16.4.1 Establishment of Data Link

(1) Upon input of [YES] for host communication on the start condition screen, the analyzer side transfers ANY frame to the host. This marks the start of communication.

(2) Once a text has been sent, the direction of transmission is reversed and the receiver can send the next response or text. In subsequent steps, the analyzer and host continue transmission alternately.



16.4.2 Response to Information

(1) Upon receiving information, the receiver sends a response or text (see Table 16-4) to inform the sender of the receiver status and the validity of received information.

(2) Used for response is a text in which a character identifying its purpose (frame character) is put between STX and ETX. When the 256-byte mode is selected for the transferred byte count, the analytical data text may exceed 256 bytes (including STX and end-of-data code) depending on sample. In this case, the text is analyzed, the analyzed text is put between STX and ETX and a frame character to identify the number of transmissions is added in the text.

(3) After sending a text, sending should be avoided until reception of a response or request to/for the text in a normal condition. If sending is attempted, the analyzer side ignores it. (Trace will not be made either.)
If no response is returned or an invalid response is received, the recovery procedure is executed. In case of sending from the host, it must always be kept ready for receiving.

(4) If the host did not return a response in the communication cycle (NOTE) on communication from the analyzer, alarm is displayed on the screen of analyzer.

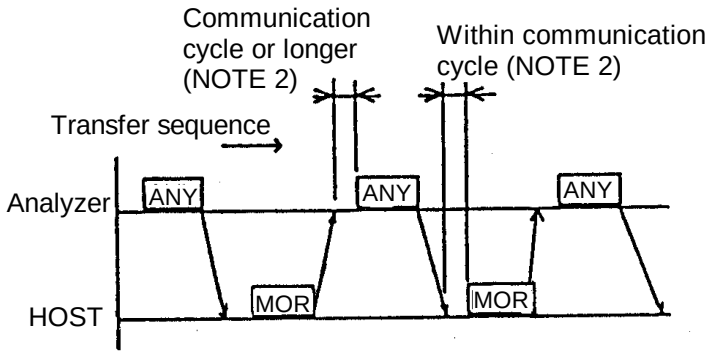
NOTE: Time period is changeable on the communication parameter screen. It is defaulted to 2 sec.

16.4.3 Response to Information Message

Described below are the typical procedure for returning a response to the information message and the procedure upon receiving the response.

(1) When there is no information to be sent (analyzer ↔ host)
(2) Transfer of communication control message (analyzer ↔ host)
(3) Transfer of test selecting information (analyzer ↔ host)
(4) Transfer of analytical data (analyzer → host)
(5) Resending request (analyzer ↔ host)

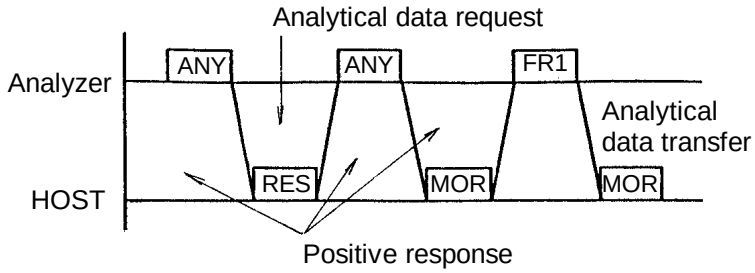
(1) When there is no Information to be Sent (analyzer ↔ host)



The analyzer continues returning the ANY frame in response to the MOR frame from the host so as to respond to the request from the host at any time even when the analyzer and host have no information to be sent (NOTE 1).
In this case, the analyzer sends the ANY frame at one communication cycle or longer (NOTE 2) after receiving the MOR frame from the host (at time point when the final end-of-data code is recognized).

NOTES:
1. When the following conditions are satisfied:
   (a) There is no test selecting information to be sent to the host.
   (b) Analytical data is not output in the real-time mode.
   (c) There is no request for the RES frame.
   (d) Specification through the screen is not made.
2. This time period is changeable on the communication parameter screen. Default value is 2 sec.

(2) Transfer of Communication Control Message (analyzer ↔ host)



The RES, ANY, MOR, REP, SUS and REC frames are available for the communication control messages.
For details, refer to Table 16-4.

(a) RES frame

The host can make a request to the analyzer side (just called "analyzer" hereafter) for analytical data of a specific sample by use of the RES frame. However, the analyzer sends the ANY frame in the following cases.

(i) The analyzer has no relevant data.

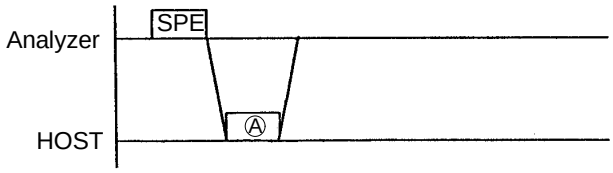
(ii) FD error occurs during access to the relevant sample data.

Data is transferred in the received sequence, starting from completion of transmitting the measurement result data in real-time mode.
The analyzer is capable of storing data of up to 10 routine samples in each of ID mode and sample No. mode. That is, data of more than 11 samples is ignored.
The analyzer does not transfer measurement data in case of sending from the host in the sample No. mode (without ID) though ID is provided.
If transferring the RES frame from the host when FD is occupied by a factor, the presence or absence of an FD error is checked with the relevant factor terminated. The result of FD error check is described below. During this process, communication is in the event occurrence status.

1) If FD error is absent..... RES frame is transferred.
2) If FD error is present ..... RES frame is not transferred.

When interruption is cased by RES frame during batch transfer, a batch-specified sample may be transferred before one sample because FD access time is allowed. In this case, after the text for one batch-specified sample is transferred, the RES frame will be transferred.

(3) Transfer of Test Selecting Information (analyzer ↔ host)

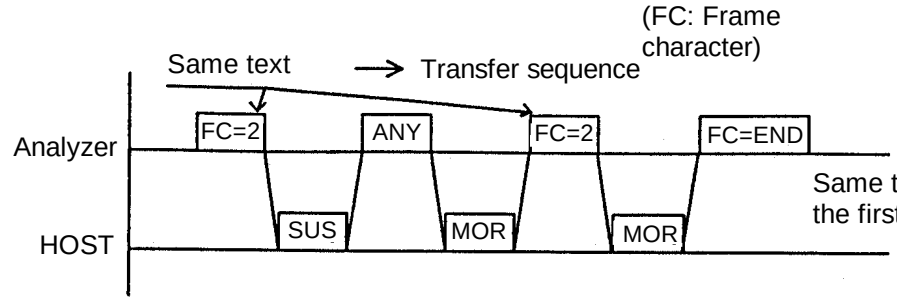


Response from host

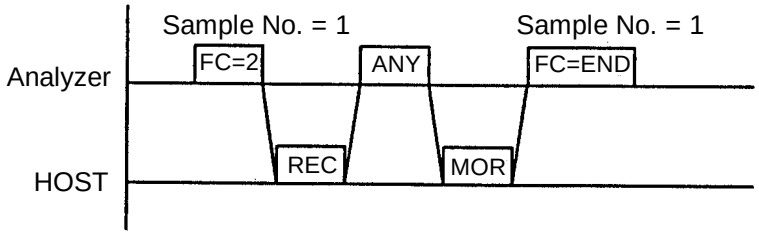
Frame Ⓐ	Description
SPE	To return test selecting information for a sample sent from analyzer
MOR	To indicate that host cannot respond to test selecting information inquiry but is ready to receive analytical data
REC	To suspend communication with analyzer for the specified period of time because host cannot respond to test selecting information inquiry nor receive analytical data

Difference in Transfer between SUS and REC Frames

(a) In sending from host



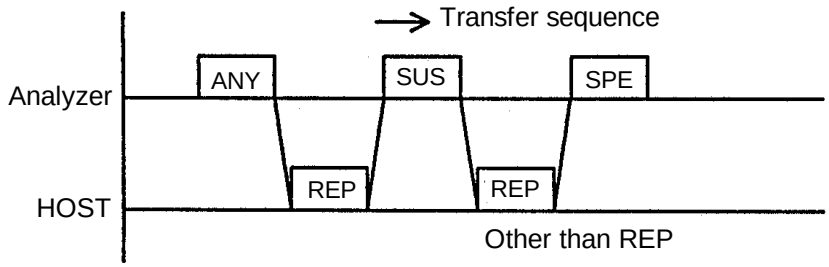
Same text is transferred after the first MOR reception.



After MOR reception, not the same text but the next analytical data text is transferred. If text FC = 2 is the same as FC = END, the analytical data text of the next sample is transferred.

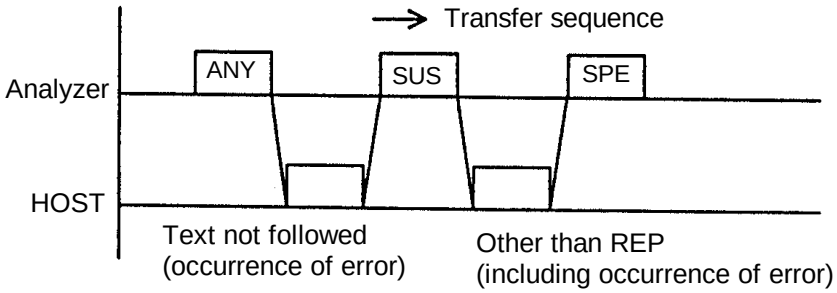
(b) In sending SUS frame from analyzer

Example 1: REP frame is returned for ANY frame from the analyzer.



(Example 1)

Example 2: An error occurred on response to ANY frame from the analyzer.

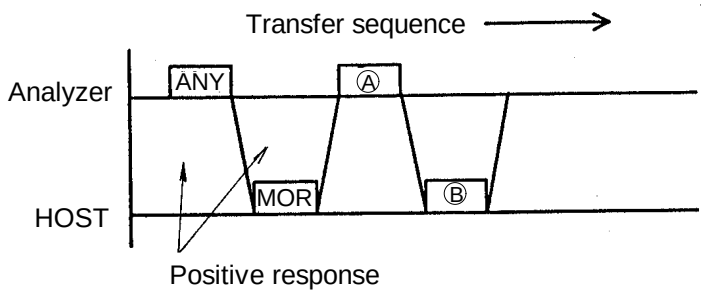


(Example 2)

(4) Transfer of Analytical Data (analyzer → host)

The analyzer can send analytical data to the host only when the host has transferred the MOR frame to the analyzer.

(a) Transmission procedure in normal case



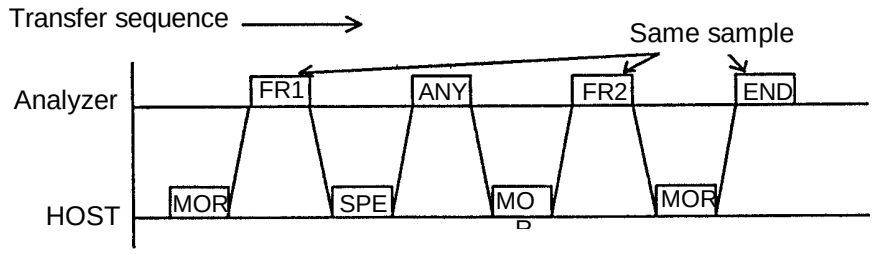
Response from analyzer

Frame Ⓐ	Description
FR1 to END	Analytical data (including calibration result and absorbance data in entire reaction process)

Response from host

Frame Ⓑ	Description
REP	When text in Ⓐ is abnormal
MOR	To receive analytical data next time as well
REC	To avoid reception of analytical data next time
SUS	To suspend communication
SPE	To specify test selection
RES	To request a specific sample

(b) Transmission procedure in special case
Even if the host sends any other frame than MOR while the analyzer is transferring a sample having 2 or more tests to the host, the analyzer responds to the relevant frame and resumes sending from a succeeding text upon receiving the MOR frame.

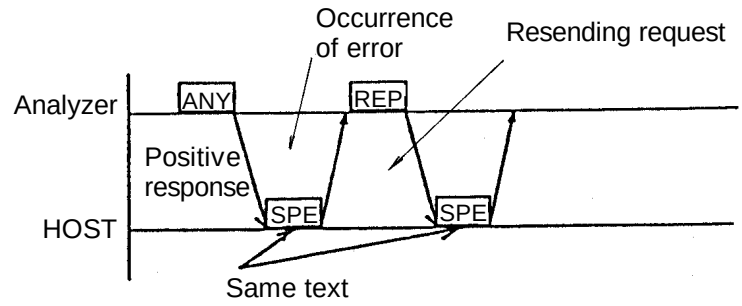


Effect of this system: (1) No delay for SPE
(2) Identifiable by host because sample identifying information is provided for each text

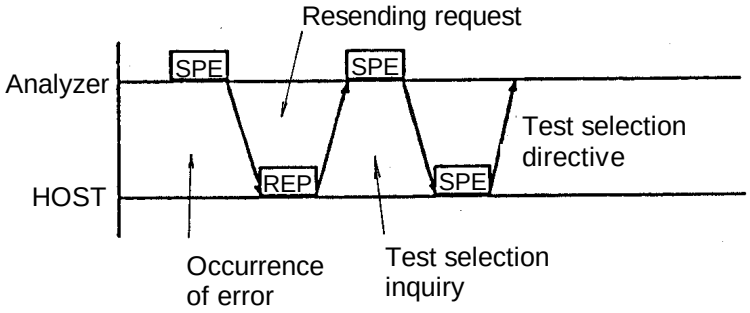
(5) Resending Request (analyzer ↔ host)

Resending is requested if there is any abnormality in the contents of the text received from the opposite side or to request the same text again for some reason.

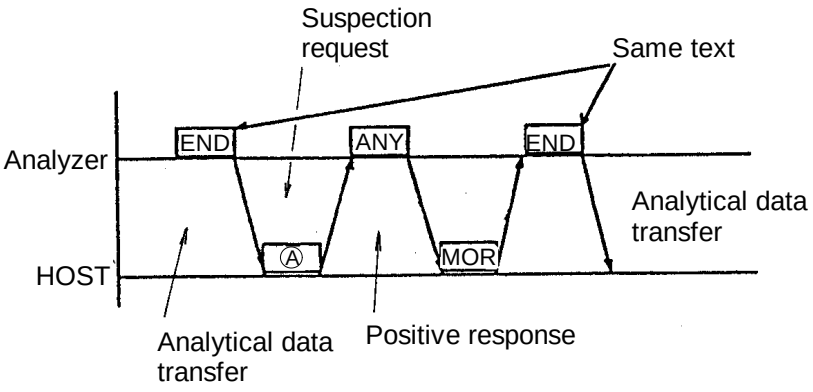
(a) From analyzer to host



(b) From host to analyzer

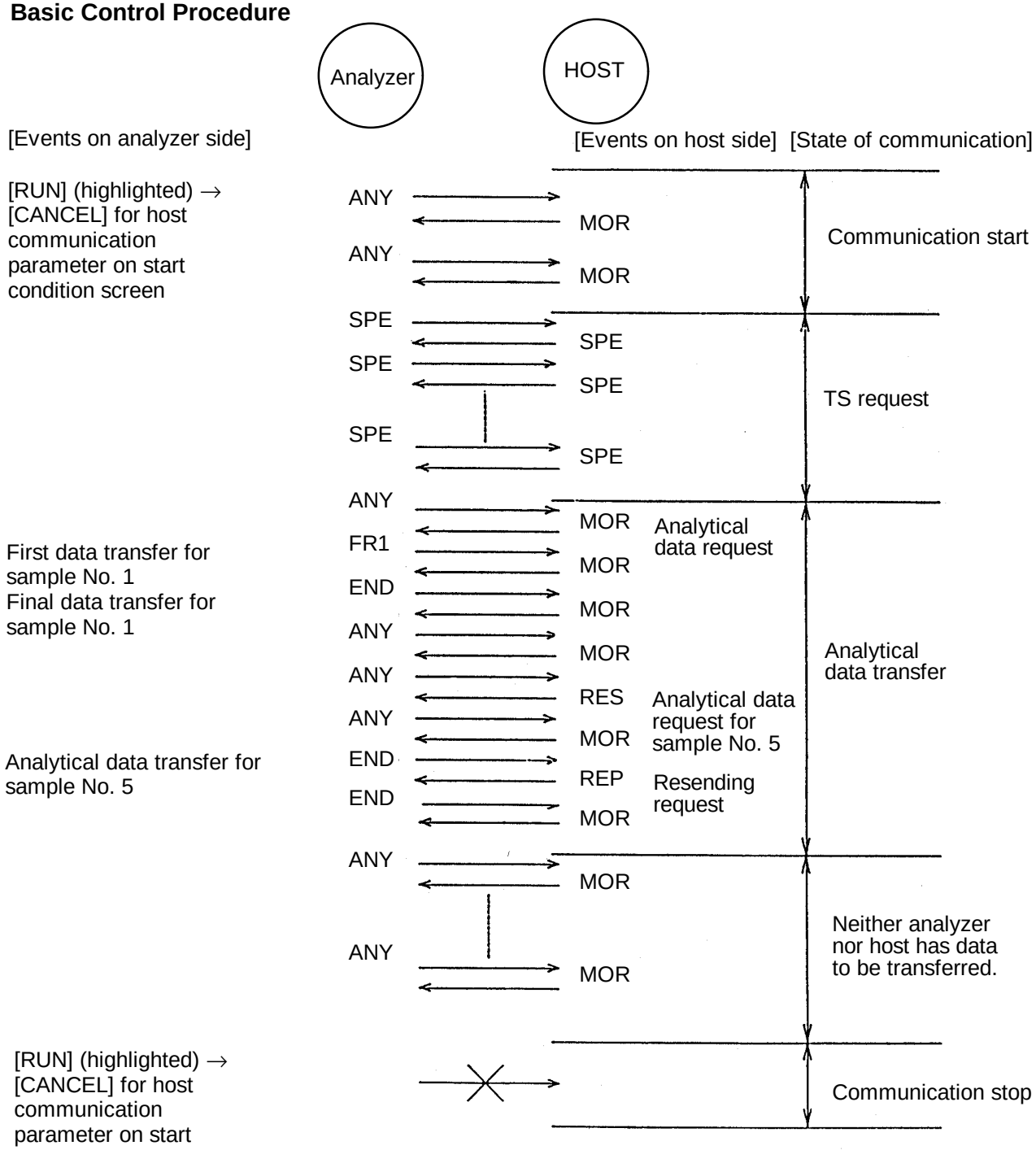


(c) For resending with other than REP



Frame Ⓐ	Description
SUS	Sent from host when it wants analyzer to suspend communication for the specified time. In this case, the analyzer judges that host could not receive the text for some reason, and when communication is restored (MOR frame is sent from host), the finally sent text, if it is an analytical data text, is resent to restart communication.
REC	Sent from host when it wants analyzer to suspend communication for the specified time. In this case, the analyzer judges that host could receive the analytical data text normally and the analytical data text is not resent after reception of MOR frame.

Basic Control Procedure



Contents of Each Frame

	Contents
SPE	TS request for one specific sample
SPE	TS response for one specific sample
FR1, END	Analytical data transfer
RES	Analytical data request for specific sample
REP	Resending request

16.4.4 Termination and Restart of Communication

Table 16-5 shows the conditions for termination and restart of this protocol.

Table 16-5 Termination and Restart of Communication

O: Communication stopped ×: Communication continued

Conditions for Termination	Real-time Communication	Batch Communication	Restart of Communication
Change from [YES] to [NO] or in [NO] for host communication parameter on start condition screen	×	×	Change from [NO] to [YES] for host communication parameter. Restart is made with previous contents of communication all canceled.
Occurrence of send/receive time-out error	O	O	Same as above (NOTE 2)
Occurrence of hardware error alarm related to communication	O	O	Same as above (NOTE 2)
Occurrence of FD read error during sending of analytical data to host	O	×	Remaining samples in specified range are not sent. On restart, samples in newly specified range are sent.
Specification of stop through screen during batch sending of analytical data to host	O	× (NOTE 1)	Same as above
Occurrence of FD read error during transfer of analytical data for specific sample request to host	O	O	Relevant sample alone is canceled.
Detection of error in text such as BCC error or discrepancy in end-of-data code between analyzer and host	O	O	—
Occurrence of E.STOP-level alarm on analyzer side	O	O	—

NOTES: 1. Transfer of measurement result data is stopped regardless of the kind of sample (routine or control).
2. Retry processing is executed up to the specified number of retry times. In excess of the specified number, communication is stopped.

16.4.5 Priority

When multiple processings concur in response to a request from the host, the analyzer assigns priority to them for returning its response to the host.

However, batch communication is suspended in units of text for transferring to the host the text which has a higher priority than batch communication when it interrupts batch communication under execution (restricted to the cases where analytical data in the real-time mode is output from analyzer and analytical data alone is transferred in response to RES frame).
(Discrimination between real-time communication data and batch communication data depends on the function frame.)
Then, batch communication is restarted.
Table 16-6 gives the details of each frame and the priority.

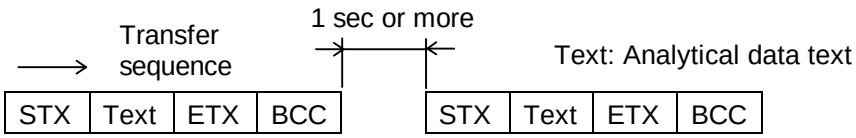
Table 16-6 Details of Each Frame and Priority

Priority	Item
1	Sending of SPE (stat sample)
2	Sending of SPE (routine sample) frame
3	Sending of REP (resending request) frame
4	Sending of analytical data in response to RES from host (transfer of data read from FD)
5	Sending of higher-priority analytical data (transfer of data read from FD)
6	Sending of lower-priority analytical data (analytical data in real-time communication)

16.4.6 RESULT ONLY Mode

In this mode, only the measurement result data is transferred to the host. This mode does not accept a resending request (REP frame) from the analyzer or host and a specific sample data request. When [YES] is set for "transfer of analytical data alone" on the communication parameter screen, the analyzer returns response to neither test selecting inquiry for routine/stat samples nor specification of test selection from the host.

The analyzer waits for 1 sec or more after sending ETX in the analytical data text and proceeds to transfer to the host regardless of the communication procedure.



16.4.7 Retry of Communication

Retry is a function for resending the text sent from the analyzer to the host immediately before occurrence of any communication error.

(1) Retry Due to Time-Out

(a) Reception time-out
If response is not received beyond the response wait time limit (NOTE 1) after sending a text from the analyzer, reception time-out occurs and retry is made. When the number of retries (NOTE 2) exceeds the maximum number of retries allowed for time-out (NOTE 3), communication will be suspended.

(b) Transmission time-out
If a text cannot be sent from the analyzer, transmission time-out occurs and retry is made after one communication cycle or longer. When the number of retries (NOTE 2) exceeds the maximum number of retires allowed for time-out (NOTE 3), communication will be suspended.

NOTES: 1. Time period is changeable by retry time entry on the communication parameter screen.
2. The number of retries made consecutively
3. Retry time is changeable by entry for the number of retries on the communication parameter screen.

(2) Retry Due to Communication Error

If a communication error (NOTE 4) occurs, retry is made immediately before the end of current communication cycle. When the number of retries (NOTE 5) exceeds the maximum number of retries allowed before communication error (NOTE 6), the relevant resent data will be canceled and the next text will be sent.

NOTES: 4. Hardware error or text error
5. The number of retries made consecutively
6. Same as in (NOTE 3) of (1) above

16.5 Status Transition

16.5.1 Status Transition Matrix (only in non-transfer for analytical data alone)

Table 16-7

No.	Event / Status in Analyzer	Event from Analyzer: Host comm. Param. [N] ® [Y]	Host comm. Param. [Y] ® [N]	TS Inquiry Req. (TS managem't task	Real-time Data Out from 902	Transfer Req. for Specific Sample	Batch Transfer Req. from Screen	Cancel or FD Error	Event from Host: MOR (analytical data req.) Data of 2 or More Samples	MOR (analytical data req.) Final Data	REP (resending req.)	SUS (suspension req.)	REC (suspension req.)	SPE (TS specification)	RES (specific sample req.)	Time-out/ Hardware Error	Error in Text
1	Initial status ([NO] for host communication parameter)	ANY transfer/2															
2	Idling (no data to be transferred on analyzer and host sides)		1	6	3	4	4		ANY transfer/2		Previous frame/2	ANY transfer/2		ANY transfer after SPE save/2	ANY transfer after RES save/4	17	REP transfer/18
3	LPR transfer wait (before LPR tansfer)		1	7	3	5	5		LPR transfer/10		Previous frame/3	ANY transfer/3		ANY transfer after SPE save/3	ANY transfer after RES save/5	17	REP transfer/18
4	HPR transfer wait (before HPR transfer)		1	8	5	4	4	2	HPR transfer/11		Previous frame/4	ANY transfer/4		ANY transfer after SPE save/4	ANY transfer after RES save/4	17	REP transfer/18
5	HPR/LPR transfer wait (before HPR/LPR transfer)		1	9	5	5	5	3	HPR transfer/12		Previous frame/5	ANY transfer/5		ANY transfer after SPE save/5	ANY transfer after SPE save/5	17	REP transfer/18
6	SPE transfer wait (before SPE transfer)		1	SPE (current TS)/13	7	8	8		SPE transfer/13		SPE transfer/13	SPE transfer/13		SPE transfer after SPE save/13	SPE transfer after RES save/15	17	REP transfer/18
7	SPE/LPR transfer wait (before SPE/LPR transfer)		1	SPE (current TS)/14	7	9	9	6	SPE transfer/14		SPE transfer/14	SPE transfer/14		SPE transfer after SPE save/14	SPE transfer after RES save/16	17	REP transfer/18
8	SPE/HPR transfer wait (before SPE/ HPR transfer)		1	SPE (current TS)/15	9	8	8	6	SPE transfer/15		SPE transfer/15	SPE transfer/15		SPE transfer after SPE save/15	SPE transfer after RES save/15	17	REP transfer/18
9	SPE/HPR/LPR transfer wait (before SPE/HPR/ LPR transfer)		1	SPE (current TS)/16	8	9	9	7	SPE transfer 16		SPE transfer/16	SPE transfer/16		SPE transfer after SPE save/16	SPE transfer after RES save/16	17	REP transfer/18
10	Ready for LPR transfer		1	7	10	12	12		LPR transfer/10	LPR transfer (final)/2	Previous frame/10	ANY transfer/10		ANY transfer after SPE save/10	ANY transfer after RES save/12	17	REP transfer/18
11	Ready for HPR transfer		1	8	12	11	11	2	HPR transfer/11	HPR transfer (final)/4	Previous frame/11	ANY transfer/11		ANY transfer after SPE save/11	ANY transfer after RES save/11	17	REP transfer/18
12	Ready for HPR transfer LPR transfer wait		1	9	12	12	12	10	HPR transfer/12	HPR transfer (final)/10	Previous frame/12	ANY transfer/12		ANY transfer after SPE save/12	ANY transfer after RES save/12	17	REP transfer/18
13	Ready for SPE transfer		1	SPE (current TS)/13	14	15	15		SPE transfer/6					ANY transfer after SPE save/6	ANY transfer after RES save/15	17	REP transfer/18

(cont'd)

No.	Event / Status in Analyzer	Event from Analyzer: Host comm. Param. [N] ® [Y]	Host comm. Param. [Y] ® [N]	TS Inquiry Req. (TS managem't task	Real-time Data Out from 902	Transfer Req. for Specific Sample	Batch Transfer Req. from Screen	Cancel or FD Error	Event from Host: MOR (analytical data req.) Data of 2 or More Samples	MOR (analytical data req.) Final Data	REP (resending req.)	SUS (suspension req.)	REC (suspension req.)	SPE (TS specification)	RES (specific sample req.)	Time-out/ Hardware Error	Error in Text
14	Ready for SPE transfer LPR transfer wait		1	SPE (current TS)/14	14	16	16		SPE transfer/3					ANY transfer after SPE save/3	ANY transfer after RES save/16	17	REP transfer/18
15	Ready for SPE transfer HPR transfer wait		1	SPE (current TS)/15	16	15	15	13	SPE transfer/4					ANY transfer after SPE save/4	ANY transfer after RES save/15	17	REP transfer/18
16	Ready for SPE transfer HPR/LPR transfer wait		1	SPE (current TS)/16	16	16	16	14	SPE transfer/5					ANY transfer after SPE save/5	ANY transfer after RES save/16	17	REP transfer/18
17	Alarm registration (communication stopped)	Alarm display/registration Communication parameter [RUN] (highlighted) → [CANCEL] To No. 1															
18	Alarm registration (communication continued)	Alarm display/registration To previous status															

NOTE: Upon reception of the SUS or REC frame, each frame is sent after waiting for the specified time.

: Ignored
~~FR/Value~~ FR : Processing or contents of text to be sent to host
Value : Number of status to which transition is made
LPR : Analytical data transfer in real-time communication
HPR : Analytical data transfer in response to specific sample request (RES), batch transfer specified through screen

16.5.2 Status Transition Matrix (in transfer of analytical data alone)

Table 16-8

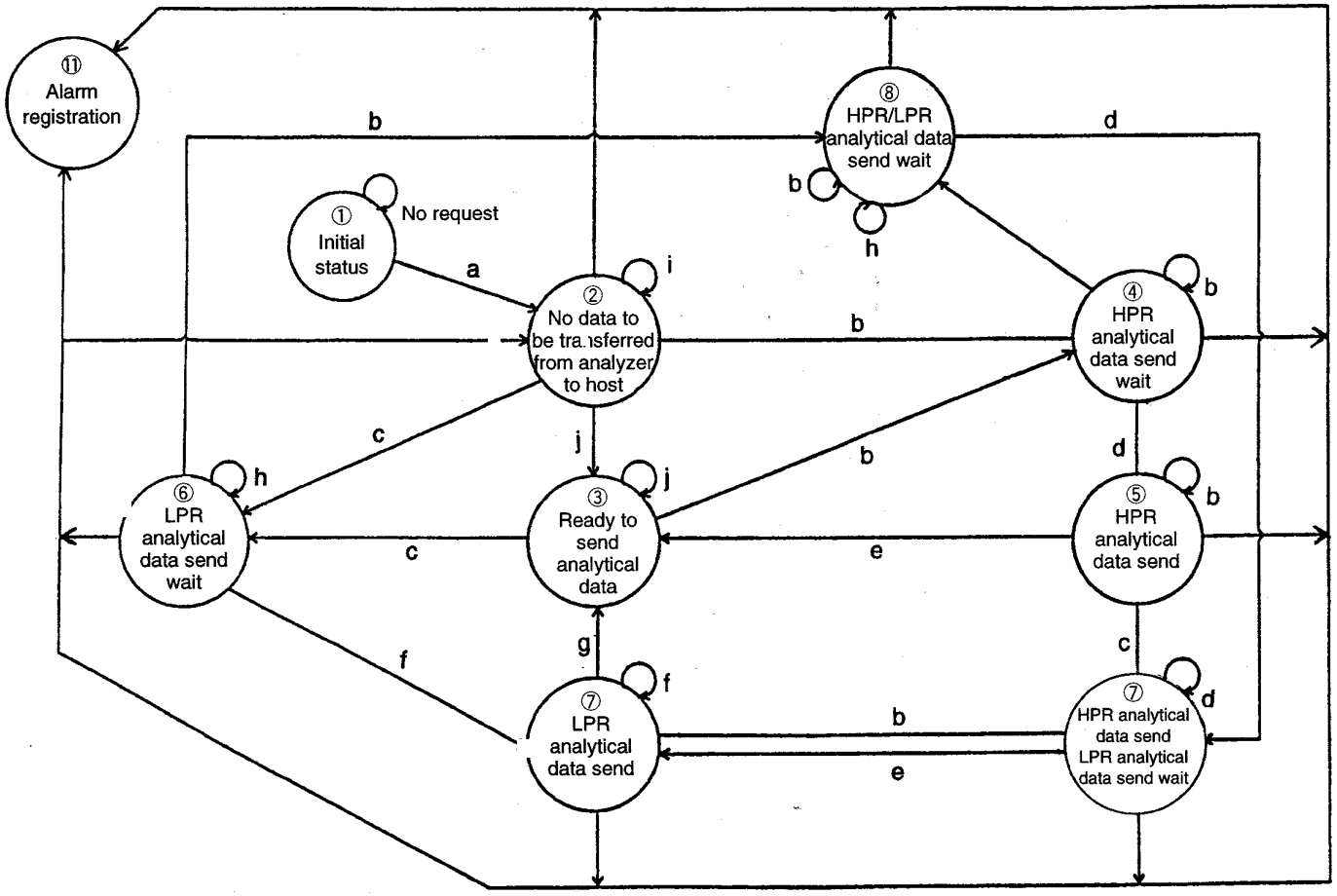
No.	Event / Status in Analyzer	Event from Analyzer								Event from Host								
		Host comm. Param. [N] ® [Y]	Host comm. Param. [Y] ® [N]	TS Inquiry Req. (TS managem't task	Real-time Data Out from 902	Transfer Req. for Specific Sample	Batch Transfer Req. from Screen	Cancel or FD Error		MOR (analytical data req.)		REP (resending req.)	SUS (suspension req.)	REC (suspension req.)	SPE (TS specification)	RES (specific sample req.)	Time-out/ Hardware Error	Error in Text
										Data of 2 or More Samples	Final Data							
1	Initial status ([NO] for host communication parameter	To 2 (status)																
2	Idling (no data to be transferred on analyzer and host sides)		1		10	11	11											
3	LPR transfer wait (before LPR transfer)																	
4	HPR transfer wait (before HPR transfer)																	
5	HPR/LPR transfer wait (before HPR/ LPR transfer)																	
6	SPE transfer wait (before SPE transfer)																	
7	SPE/LPR transfer wait (before SPE/LPR transfer)																	
8	SPE/HPR transfer wait (before SPE/HPR transfer)																	
9	SPE/HPR/LPR transfer wait (before SPE/HPR/ LPR transfer)																	
10	Ready for LPR transfer		To 1		To 10 after HPR transfer	To 12 after HPR transfer	To 12 after HPR transfer											
11	Ready for HPR transfer		To 1		To 12 after HPR transfer	To 11 after HPR transfer	To 11 after HPR transfer	To 2 immedi-ately										
12	Ready for HPR transfer LPR transfer wait		To 1		To 12 after HPR transfer	To 12 after HPR transfer	To 12 after HPR transfer	To 10 after HPR transfer										
13	Ready for SPE transfer																	
14	Ready for SPE transfer LPR transfer wait																	

(cont'd)

No	Event / Status in Analyzer	Event from Analyzer								Event from Host								
		Host Comm. Param. [N] ® [Y]	Host Comm. Param. [Y] ® [N]	TS Inquiry Req. (TS managem't task)	Real-time Data Out from 902	Transfer Req. for Specific Sample	Batch Transfer Req. from Screen	Cancel or FD Error		MOR (analytical data req.)		REP (resending req.)	SUS (suspension req.)	REC (suspension req.)	SPE (TS specification)	RES (specific sample req.)	Time-out/ Hardware Error	Error in Text (NOTE)
										Data of 2 or More Samples	Final Data							
15	Ready for SPE transfer HPR transfer wait																	
16	Ready for SPE transfer HPR/LPR transfer wait																	
17	Alarm registration (communication stopped)	Alarm display/registration Communication parameter [RUN] (highlighted) → [CANCEL] To No. 1																
18	Alarm registration (communication continued)	Alarm display/registration To previous status																

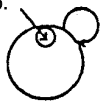
NOTE: Ignore the blank boxes in this table.

16.5.3 Status Transition Diagram (analytical data)



Symbol	Event
a	Change from [CANCEL] to [RUN] (highlighted) for host communication parameter on start condition screen
b	Output of analytical data in real-time mode from analyzer
c	Analytical data transfer requested through screen
d	MOR/HPR analytical data transfer
e	MOR/final HPR analytical data transfer
f	MOR/LPR analytical data transfer
g	MOR/final LPR analytical data transfer
h	SPE/ANY after TS registration
i	REC/ANY
j	MOR/ANY

(Example of description)
Status No.



Text to be sent from host / Text to be sent to host

Communication processing status in analyzer

←—— : Path of status transition when normal

<--- : Path of status transition when abnormal (time-out/hardware error)

HPR : Higher-priority frame (REC frame, analytical data transfer specified through screen)

LPR : Lower-priority frame (analytical data transfer in real-time mode)

16.6 Text Configuration Table

Table 16-9 shows the text configuration corresponding to the contents of each frame.

Table 16-9 Text Configuration Corresponding to Contents of Each Frame

Text Type	Text Item	Relevant Frame	Maximum Number of Characters	Sender	Contents of Text (Fu: Function character)	Reference Page
Text to indicate feature of communication	Positive response	ANY	4	Analyzer	STX | > | ETX | BCC	
		MOR		Holder		
	Negative response (resending request)	REP	4	Analyzer HOST	STX | ? | ETX | BCC	
	Suspension request	SUS	4	Analyzer HOST	STX | @ | ETX | BCC	
		REC	4	HOST	STX | A | ETX | BCC	
	Analytical data request for specific sample	RES	40	HOST	STX | < | Fu | Sample information | ETX | BCC	
Test selection inquiry text	Inquiry request	SPE	40	Analyzer	STX | : | Fu | Sample information | ETX | BCC	
Test selection specifying test	Specification request	SPE	Variable	HOST	STX | : | Fu | Sample information | Channel count | Test selecting information | Comment presence information | EXT | BCC	
Analytical data text	Routine, stat and control samples	FR1 to END	Variable	Analyzer	STX | : | Fu | Sample information | Channel count | Analytical data of 50 tests | EXT | BCC	
	Absorbance data inentire reaction process	FR1 to END	Variable	Analyzer	STX | : | Fu | Sample information | Analytical data 1 ... analytical data 4 | BLANK1 ... BLANK4 | Point count | ABS1 ... ABS35 | ETX | BCC	
	Photometry-assay calibration	END	Variable	Analyzer	STX | : | G | Text No. | STD count | Calibration alarm | STD data 1 ... STD data 6 | SD value information | ETX | BCC	
	ISE calibration	END	Variable	Analyzer	STX | : | H | ISE type | Total alarms | ISE calibration data | ETX | BCC	

Supplementary Explanation

1. Table 16-9 shows the text configuration when text size is 512 bytes.
   When a text size of 256 bytes is specified for analytical data text, two or more texts may be constituted. So refer to the description concerned.

2. Since there are 4 end-of-data codes besides ETX alone, attention should be paid when setting or referring to a text.

16.6.1 Composition of Each Text

(1) Text for Non-Specific Request (text having no data area)

(a) Composition of text

STX	FR	ETX

(FR: Frame character)

(b) Table 16-10 shows the frame name and frame character according to the sending direction.

Table 16-10

Frame Name	Frame Character	From Analyzer to Host	From Host to Analyzer
ANY	>	O	×
MOR		×	O
REP	?	O	O
SUS	@	O	O
REC	A	×	O

O: Sent × : Not sent

(2) RES: Text of analytical data request for specific sample (from host to analyzer)

(a) Composition of text

STX	<	Fu	Sample information	ETX

(Fu: Function character)

(b) Table 16-11 shows the contents of the text. Note that alarm is issued on the analyzer side if any other than routine and stat sample information (control sample or calibration information) is sent from the host to analyzer.
"Ignored" in the table means that the analyzer ignores relevant sample information even if it is specified by the host.

Table 16-11

Sample	With/ Without ID	Function Character		Sample Information			
		From Analyzer to	From Host to Analvz	From Host to Analyzer (For "from analyzer to host," refer to (5) below.)			
				Sample No.		Position No.	ID No.
Routine sample	With	a	a	Ignored			ID No. set (blank unallowable)
Routine sample	Without	n	n	Sample No. set (1 to 400)	Ignored		
Stat sample	With	d	d				ID No. set (blank unallowable)
Stat sample	Without	g	g	Sample No. set (1 to 50)	Ignored		

(3) SPE: Text for test selecting information inquiry (from analyzer to host)

(a) Composition of text

STX	;	Fu	Sample information	ETX

(Fu: Function character)

(b) Contents of text
For the contents of text, refer to "16.6.2 Contents of Text."

(c) Text type
Text for a routine or stat sample alone is sent.

(d) Condition for inquiry to host
1) When test selection on the analyzer side includes a sample for which no test is requested (provided [YES] is specified for full-time inquiry)
2) When an ID read error has occurred with the barcode reader is provided. At this time, ID No. becomes blank.

(e) Condition for rejecting inquiry to host
[YES] is specified for the transfer of analytical data alone on the communication parameter screen.

(f) Whether test selection inquiry is made to the host for every sample or only when no test is selected on the analyzer side is selectable by the full-time inquiry parameter on the communication parameter screen.
1) When [YES] is specified for full-time inquiry, inquiry is made regardless of test selecting registration on the analyzer side.
2) When [NO] is specified for full-time inquiry, inquiry is made only when test selection on the analyzer side includes a sample for which no test is requested.

(g) When [YES] is specified for the original Abs., test selection inquiry is not made to the host.

(h) At inquiry in the real-time mode with or without ID, a sample No. is added. (Sample information is detailed below.)
1) Items to be set with ID .....Sample No., position No., ID No.
2) Items to be set without ID .....Sample No., position No., ID No. (treated as comment) (allowed even if inquiry ID is different)

(4) SPE: Specification of test selection (from host to analyzer)

(a) The composition of SPE text is shown below. For the contents of text, refer to "16.6.2 Contents of Text."

STX	;	Fu	Sample information	Channel count	Test selecting information	Space (5)	ETX	BCC

(b) Test selecting information request from the host will correspond to sample information sent upon test selection inquiry. If not, however, it is taken into the analyzer and inquiry is not made again.

(c) If a time-out error, hardware error or any other error occurs, the relevant sample is considered to have not been received and is ignored after occurrence of the alarm.

(d) When no request is made for all of the test selecting information received on the host side, it is registered that none is requested.

(e) When the barcode reader is provided, the analyzer ignores the sample No. of routine sample even if it is sent from the host.

(f) Even when the same ID No. is transferred to the analyzer multiple times with the barcode reader provided, registration will be made in response to position No.

(g) Where the barcode reader is not provided, a test selection response from the host to the real-time inquiry should be made within two cycles (= 36 seconds). If this period of time is exceeded, the analyzer does not accept the test selection request.

(h) Unless the barcode reader is provided, the same position No. as on the analyzer side is set and transferred.

(i) Specification of test selection made from the host is ignored if the analyzer is set in the original Abs. mode. In test selection, priority is given to the analyzer side.

(j) Sample No., position No. and ID No. sent from the host may become invalid depending on the mode of analyzer.

O: Host's specification followed ×: Invalid

Sample	With or Without ID	Sample No.	Position No.	ID No.	Remarks
Routine sample	With (ID mode)	×	×	O	
	Without (sample No. mode)	O	O	O	
Stat sample	With (ID mode)	×	O	O	As disk position No., send the same No. as the inquiry No. from analyzer.
	Without (sample No. mode)	×	×	×	Inquiry is not made in this mode.

Table 16-12 Detailed Information about "SPE: Text for test selecting information inquiry (from analyzer to host)"

TS: Test selecting information

Operation Mode	Instrument Mode	Sample Name	Inquiry Condition [RUN] (highlighted) is specified for host communication on start condition screen, [NO] is specified for the transfer of analytical data alone on the [communication parameter screen and [NO] is specified for original Abs.		2 Characters Function Character	Sample Information 5 Characters Sample No.	1 Character Unassigned	3 Characters Position No.	13 Characters ID No.	15 Characters Unassigned	Remarks
Simple analysis mode	ID mode	Routine sample	Press the registration key on the screen by the same times as the sample count for inquiry.	Sample unregistered	A ␣	1 to 400	Space	1 to 35	ID read with barcode reader	Space	Even if a barcode read error occurs due to an unregistered sample, inquiry is made with position No. assigned.
				Sample registered					Same as above		Inquiry is not made when [NO] is specified for full-time inquiry and TS request lasts 1 channel or more.
		Stat sample	When [RUN] (highlighted) is specified for stat sample test selection, inquiry is made while reading barcode from the position specified for stat sample position setting parameter.		D ␣	1 to 50	Space	2 to 35	Same as above	Space	Same as above
	Sample No. mode	Routine sample	Press the registration key on the screen by the same times as the sample count for inquiry.	Sample unregistered	N ␣	1 to 400	Space	1 to 35	ID registered on screen [handled as comment]	Space	Same as above
				Sample registered							
		Stat sample	Inquiry is not made.								
Routine analysis mode	ID mode	Routine sample	Inquiry is made by reading barcodes sequentially from position No. 1.	Sample unregistered	A ␣	Space	Space	1 to 35	ID read with barcode reader	Space	Inquiry is not made when an unregistered sample causes barcode read error.
				Sample registered					Same as above		Inquiry is not made when [NO] is specified for full-time inquiry and TS request lasts 1 channel or more.
		Stat sample	When [RUN] (highlighted) is specified for stat sample test selection, inquiry is made while reading barcode from the position specified for stat sample position setting parameter.		D ␣	Space	Space	2 to35 (position Nos. read by barcode reader)	ID registered on screen When barcode reading is successful, inquiry is made via the read ID. When unsuccessful, inquiry is made via the ID specified on screen	Space	Same as above
	Sample No. mode	Routine sample	Inquiry is made for the specified number of samples sequentially starting from the sample specified in the analysis start No. on start condition screen.	Sample unregistered	N ␣	1 to 400	Space	1 to 35	ID registered on screen [handled as comment]	Space	Same as above
				Sample registered		1 to 400					
		Stat sample	Inquiry is not made.								

Supplementary Explanation

1. If no response is available from the host within 2 cycles (36 sec) after inquiry to the host, analysis is carried out according to the TS of main frame.
   If the main frame has no TS request, the relevant sample will not be analyzed.

Table 16-13 Detailed Information about "SPE: Specification of test slection (from host to anal yzer)"

Operation Mode	Instrument Mode	Sample Name	Basic Condition for TS Specification [RUN] (highlighted) is specified for host communication on start condition screen, [CANCEL] is specified for the transfer of analytical data alone on the [communication parameter screen and [CANCEL] is specified for original Abs.	2 Characters Function Character	Sample Information, Recommended Character in Parens 5 Characters Sample No.	1 Character Unassigned	3 Characters Position No.	13 Characters ID No.	15 Characters Unassigned	Stop Specification from HOST	Remarks
Simple analysis mode	ID mode	Routine sample	New sample (Press the registration key on screen by the number of samples to be analyzed.)	A ␣	(Space) Ignored	(Space) Ignored	1 to 35	Desired ID No. (blank unallowable)	(Space) Ignored	Unallowable	[Caution 1] The position No. specified from the host must be within the range specified on the stat sample position setting screen. If the position No. is outside the range or 0 is specified, sample information error occurs.
		Stat sample	Sample registered for stat TS through screen	D ␣	(Space) Ignored	(Space) Ignored	2 to 35 [Caution 1]	Sample and ID No. registered on screen (blank unallowable)			
	Sample No. mode	Routine sample	New sample (Press the registration key on screen by the number of samples to be analyzed.)	N ␣	1 to 400	(Space) Ignored	1 to 35	Desired 13 characters (blank unallowable)	(Space) Ignored		
		Stat sample	Sending is unallowable.								
Routine analysis mode	ID mode	Routine sample	New sample (Specify the analysis start No. and the number of samples to be analyzed through screen.)	A ␣	(Space) Ignored	(Space) Ignored	1 to 35	Desired ID No. (blank unallowable)	(Space) Ignored	Unallowable	
		Stat sample	Sample registered for stat TS through screen	D ␣	(Space) Ignored	(Space) Ignored	2 to 35 [Caution 1]	Sample and ID No. registered on screen (blank unallowable)	(Space) Ignored	Unallowable	
	Sample No. mode	Routine sample	1. New sample 2. Registered sample	N ␣	1 to 400	(Space) Ignored	1 to 35	Desired 13 characters (blank unallowable)	(Space) Ignored		
		Stat sample	Sending is unallowable.								

Supplementary Explanation

1. Basically, text should be transferred with TS and comment presence/absence information added to the same sample information (excluding ID No.) as for inquiry from the analyzer.

(5) Analytical Data Transfer (from analyzer to host)

Shown below are the contents of each text.

(a) Analytical data transfer for routine, stat and control samples
The text size (number of transferred words between STX code and end code) is selectable tetween the two given below.

Table 16-14 Text Size and Composition

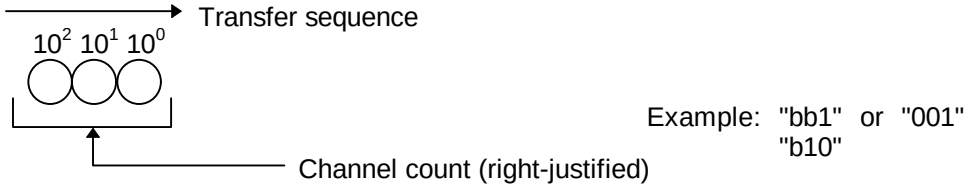
Text Size	Mode	Text Composition (B: Byte count)	Max. Test Count/text	Max. Text Count	Channel Count	Remarks
256	Real time or batch	1b 1b 2b 37b 3b 10b× test count n 1b 1b 1st STX | 1 | Fu | Sample information | Channel count | Analytical data | ETX | BCC (1ch to 20ch) Final STX | : | Fu | ↑ | ↑ | ↑ | ETX | BCC (21ch to 40ch)	20	2	40 or less	Max. text count is 1 when channel count is 20 or less.
		1st STX | 1 | Fu | ↑ | ↑ | ↑ | ETX | BCC (1ch to 20ch) 2nd STX | 2 | Fu | ↑ | ↑ | ↑ | ETX | BCC (21ch to 40ch) Final STX | : | Fu | ↑ | ↑ | ↑ | ETX | BCC (41ch to 51ch)		3	Within 41 to 51	
512	Real time or batch	1st STX | 1 | Fu | ↑ | ↑ | ↑ | ETX | BCC (1ch to 46ch) Final STX | : | Fu | ↑ | ↑ | ↑ | ETX | BCC (47ch to 51ch)	46	2	51 or less	

The text size (number of transferred words between STX code and end code) is selectable between the two given below.

NOTES: 1. The end code character is settable up to four characters. So calculate the maximum number of transferable channels according to the expression shown below. (Fractions are rounded down and a numerical value '48' indicates the total byte count of fixed length n in Table 6-4.) Text size: 256 or 512 bytes

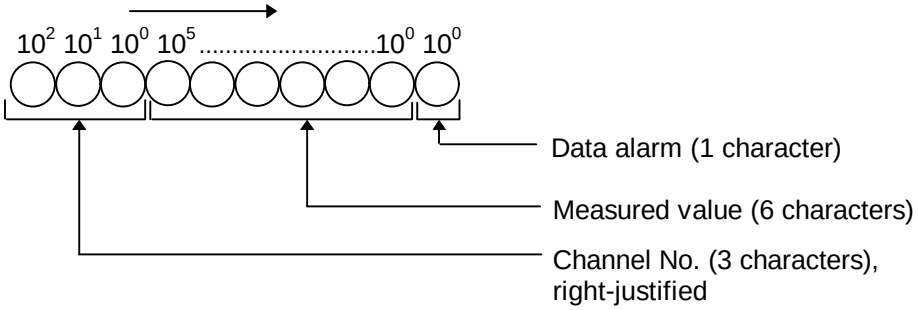
$$\text{Maximum number of transferable channels} < \frac{\text{Text size} - 48}{10}$$

2. In batch communication in the 256-byte mode, data is sent in up to five texts for each sample.
   In this case, the analyzer sends the first text and then the next one soon after reception of the MOR frame from the host.
3. The total number of analytical data to be transferred is variable according to the number of specified channels.
4. When ISE data or serum indexes extend into the next text, they are set in it for transfer.
5. When the absence of ISE unit is set on the system setting screen or by the DIP switch, the analytical data of ISE tests will not be sent.
   1) Channel count (3 characters)
      The number of channels to be transferred in one text is sent.



NOTE: The analyzer transfers data for up to 36 channels in both real-time communication and batch communication. When including serum indexes (three tests of lipemia, hemolysis and icterus), electrolytes (three tests of Na, K and Cl) and calculation tests (8 tests), data for up to 50 channels is transferable.

   2) Analytical data 1 to n (10 characters each)



(i) Channel No.

Table 16-15

Channel No.	Description	Remarks
" bb1 " to " b36 "	Photometry assay	1 to 36 without ISE
" b38 " to " b40 "	Electrolyte	
" b41 " to " b43 "	Serum index	
" b44 " to " b51 "	Calculation test	

(ii) Measured value

Table 16-16

Positive/negative	Decimal Point	Max. Digit Count	Example
Positive	Absent	6	1 2 3 4 5 6
	Present	5	1 2 3 . 4 5
Negative	Absent	5	- 1 2 3 4 5
			b b - 1 2 3
	Present	4	- 1 2 . 3 4
			b - 1 2 . 3

(b: Space)

Table 16-17

Channel No.	Description	Form	Position of Decimal Point	Remarks
1 to 36	Concentration value in photometry assay	6 digits with sign and decimal point	Decimal point position in concentration value of standard 1 on chemistry parameter screen	
38 to 40	Concentration value of electrolyte	Same as above	Decimal point position in concentration value of LOW solution on ISE parameter screen	
41 to 43	Measured value for serum index	6-digit integer with sign	Zero at any time	
44 to 51	Calculated value in calculation test	6 digits with sign and decimal point	Decimal point position in standard value range (lower limit) on calculation test screen	

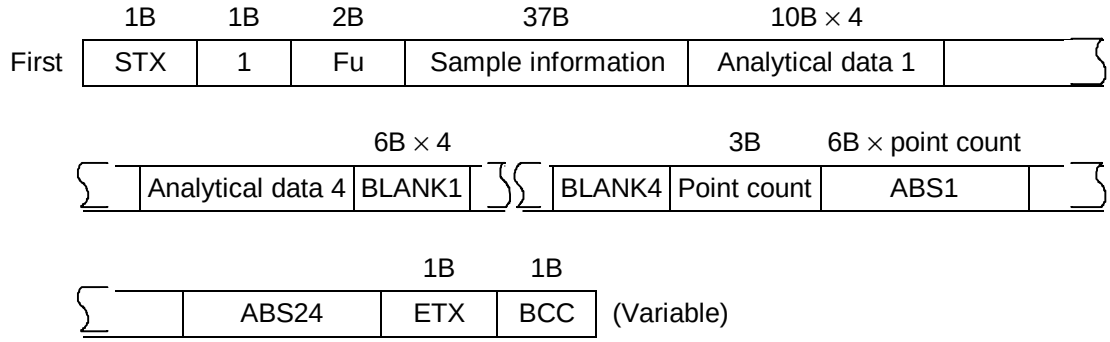
(iii) Data alarm
For details, refer to the data alarm code list.

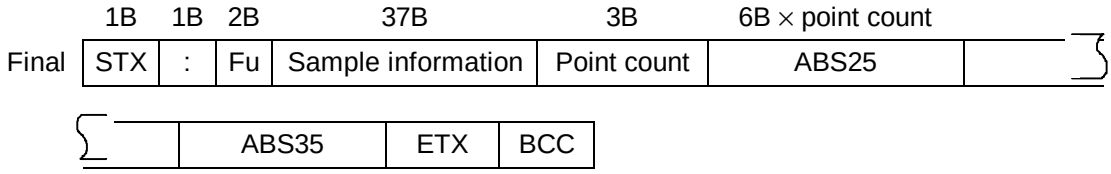
(b) Transfer of absorbance data in entire reaction process (from analyzer to host)

1) Specification of size

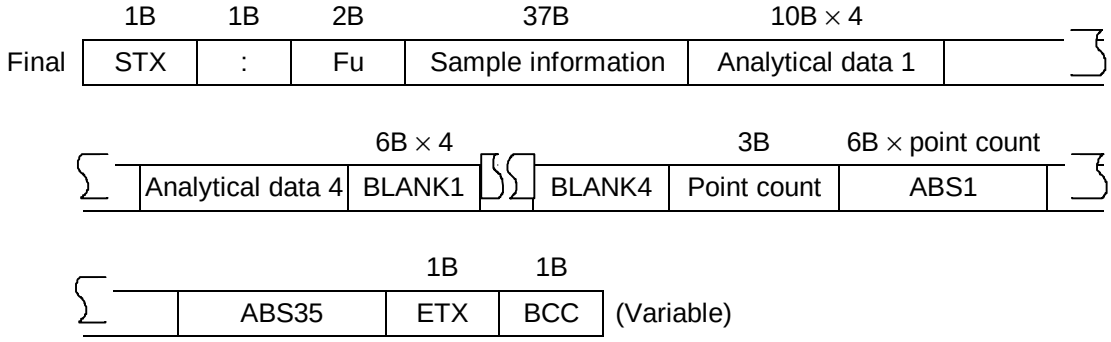
The size of text is specifiable on the communication parameter screen. Select either 256 or 512 bytes. On selection of 256 or 512 bytes, text is transferred divided as shown below.

(i) When 256-byte mode is specified for text size





(ii) When 512-byte mode is specified for text size



2) Transfer unit

This text is transferred in units of channel. Even when the text size is 256 bytes, transfer is completed in a single text if the point count is 24 or less. The frame character at that time is not '1' but ':'.

3) Sample information

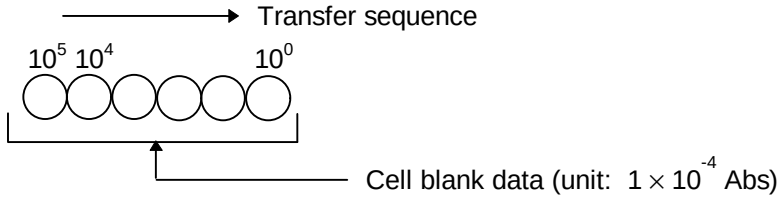
Refer to "sample information" in (2) of 16.6.2.

4) Analytical data 1 to 4 (10 characters each)
   (i) For transfer format, refer to (2) of 16.6.1.
   (ii) Table 16-18 is followed when there is no relevant test for analytical data 1 to 4.
   (iii) When two-channel simultaneous measurement is specified, data for two channels is transferred, and data for up to four channels (1 channel + L, H, I) is transferred when serum index measurement is specified.

Table 16-18

	Setting
Channel No.	" bbb "
Measured value	" bbbbbb "
Data alarm	" b "

5) BLANK 1 to 4 (6 characters each)
The transfer format of each cell blank data is shown below.



(Example) bbb-50

6) Point count (3 characters)
The number of photometric points to be transferred in one text is transferred.

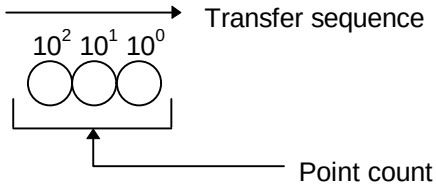


Table 16-19

Reaction Time	3 min	4 min	5 min	10 min
Point Count	11	14	17	35

7) ABS 1 to 35
Absorbance data in the entire reaction process (difference data between two wavelengths at each photometric point) is transferred in the same format as of the above cell blank data. When the point count is less than 35, data is closely transferred in sequence starting from ABS 1.

(c) Transfer of photometry-assay calibration data (from analyzer to host)

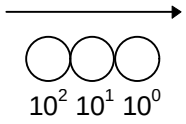
Composition of text

STX (1)	: (1)	G ␣ (2)	Channel No. (3)	STD count (1)	Calibration alarm (1)	STD data 1 (32)	

Each parenthesized numeral indicates the byte count.

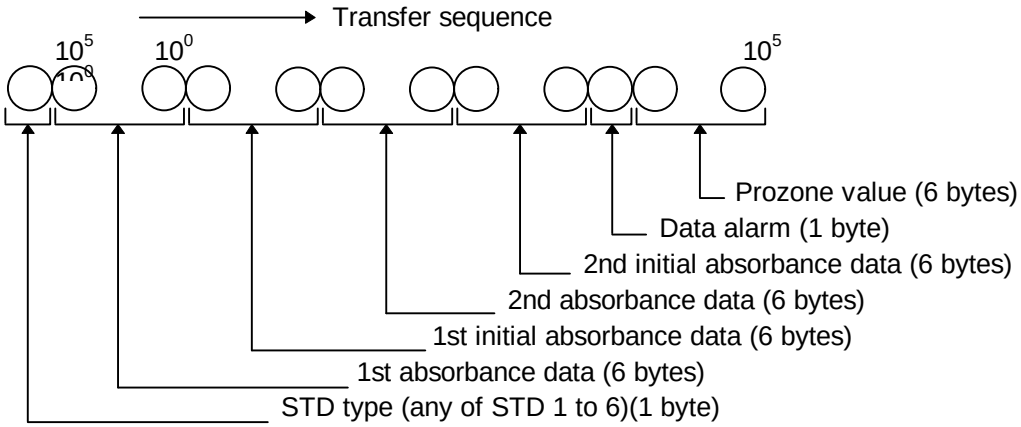
	STD data 6 (32)	SD value information (8)	ETX (1)	BCC (1)	(Variable)

1) Frame character (1 character)
':' is transferred.
2) Function character (2 characters)
'G ␣ ' is transferred.
3) Channel No. (3 characters)



A test code in photometry-assay calibration is indicated in a three-digit integer. Test numbers are "bb1" to "b36" which correspond to test codes in the analyzer.

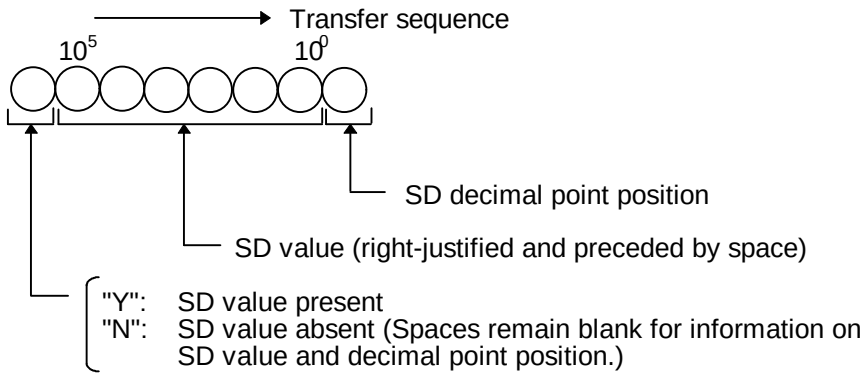
4) STD count (1 character)
STD count is any of '1' to '6' and variable according to the calibration method. When STD count is '1,' STD data is followed immediately by SD value information.
5) STD data 1 to 6 (32 characters each)
The data for each STD has the composition below.


Transfer sequence
10^5
10^0
10^5
Prozone value (6 bytes)
Data alarm (1 byte)
2nd initial absorbance data (6 bytes)
2nd absorbance data (6 bytes)
1st initial absorbance data (6 bytes)
1st absorbance data (6 bytes)
STD type (any of STD 1 to 6)(1 byte)

Each absorbance data is right-justified and preceded by one more spaces.

6) Calibration alarm (1 character)
Refer to the data alarm code list.

7) SD value information (8 characters)


Transfer sequence
10^5
10^0
SD decimal point position
SD value (right-justified and preceded by space)
"Y": SD value present
"N": SD value absent (Spaces remain blank for information on SD value and decimal point position.)

8) Data composition

Table 16-20

Data Item	Unit	Form	Decimal Point Position
Absorbance data	10^{-4} ABS	6-digit integer with sign	No decimal point
Initial absorbance data	10^{-4} ABS	6-digit integer with sign	No decimal point
SD value	No	6 digits with decimal point (positive)	Decimal point position of SD limit on chemistry parameter screen

9) Transfer unit
Transfer in units of channel

(d) Transfer of ISE calibration data (from analyzer to host)

Composition of text (B: Byte count)

	1B	1B	2B	1B	1B	72B
Type A	STX	:	H ␣	ISE type	Na data alarm	Na calibration data

1B	72B	1B	1B		
K data alarm	K calibration data	ETX	BCC	(Unused)	(153 bytes)

Type B	STX	:	H ␣	ISE type	Na data alarm	Na calibration data

			1B	72B			
K data alarm	K calibration data		Cl data alarm	Cl calibration data	ETX	BCC	(226 bytes)

1) Frame character (1 character)
':' is transferred.
2) Function character (2 characters)
'H_' is transferred.

3) ISE (electrolyte) type (1 character)

Table 16-21

ISE Type	Test
'A'	Na, K
'B'	Na, K, Cl

(Unused)

4) Data alarm for each channel (1 character)
A data alarm corresponding to each channel is transferred.
For details of data alarm, refer to the data alarm code list.

5) ISE calibration data (72 characters)
This data area has eight data items; electromotive force of internal standard solution, electromotive force of LOW solution, electromotive force of HIGH solution, electromotive force of calibrator, slope level for display, concentration of internal standard solution, concentration of calibrator and compensation factor. Each data item is composed as shown below. Space remains blank when there is no relevant data.

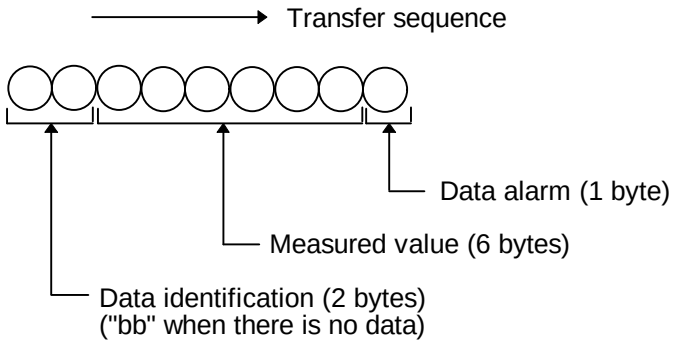


Table 16-22

Item	Data Identification	Unit	Form	Decimal Point Position
Electromotive force of internal standard solution	" b1 "	mV	6 digits with sign and decimal point	1 digit
Electromotive force of LOW solution	" b2 "	mV	6 digits with sign and decimal point	1 digit
Electromotive force of HIGH solution	" b3 "	mV	6 digits with sign and decimal point	1 digit
Electromotive force of calibrator	" b4 "	mV	6 digits with sign and decimal point	1 digit
Slope level for display	" b5 "	mV	6 digits with sign and decimal point	1 digit
Concentration of internal standard solution	" b6 "	mEg/L	6 digits with sign and decimal point	Same position as for LOW solution on ISE parameter screen
Concentration of calibrator	" b7 "	mEg/L	6 digits with sign and decimal point	Decimal point position in calibrator concentration on ISE parameter screen
Compensation factor	“ b8 ”	mEg/L	6 digits with sign and decimal point	

6) Data for up to three tests is collectively transferred to the host.
7) This text is transferred only when the ISE unit is provided at option.

16.6.2 Contents of Text

(1) Details of Function Character (Fu)

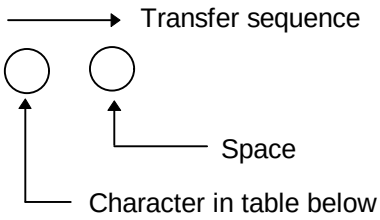


Table 16-23 Function Characters for Test Selecting Information Inquiry and Analytical Data

Sample Name	Form	Test Selecting Information Inquiry		Analytical Data	
	Direction of Communication	Analyzer ↕ Host	Analyzer ↑ Host	Analyzer → Host	
	With/without ID	Real-time Communication	Batch Communication	Real-time Communication	Batch Communication
Routine sample	With	D		A	a
Stat sample				D	d
Control sample	With or without			F	f
Calibration sample (photometry assay)	Both			G	
Calibration sample (ISE)				H	
Routine sample	Without	N		N	n
Stat sample				Q	q
Absorbance in entire reaction process (routine)	Both			I	
Absorbance in entire reaction process (stat)				K	

Supplementary Explanation

1. In the function character form for analytical data, the upper-case letters are used for real-time communication and the lower-case letters for batch communication.

2. In transfer from the analyzer to the host, batch communication for test selecting information inquiry is not carried out. (Only in simple analysis mode setting)

3. Batch communication for analytical data transfer indicates a communication when specified through the screen.

(2) Sample Information

(a) Composition of sample information

Transfer sequence →

Sample No. (5 characters)	Unassigned (1 character)	Position No. (3 characters)	ID No. (13 characters)	Unassigned (15 characters)	Unassigned (6 characters)	Unassigned (4 characters)
s s s s s		p p p	i i i i i i i i i i i i i			

(b) Details of sample information

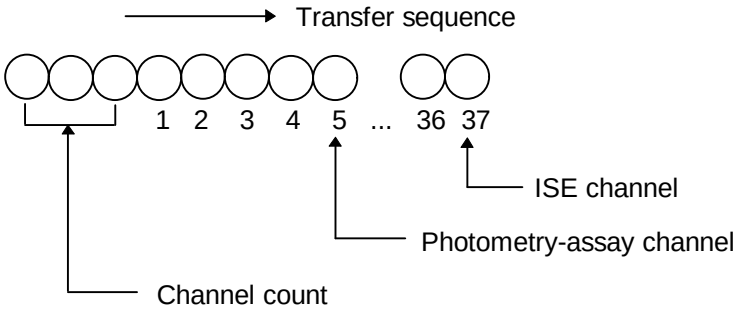
Table 16-24 shows the details of sample information.

Table 16-24 Details of Sample Information

Item	Sample Name			Remarks
	Routine Sample	Stat Sample	Control Sample	
Sample No. (5 characters)	Transfer sequence → 10^4 10^0 s s s s s — Sequence No. (bbbb1 to bb400)	Transfer sequence → 10^4 10^0 s s s s s — Sequence No. (bbb1 to bbb50)	Transfer sequence → $10^2 \cdot 10^0$ 10^1 10^0 c c c s s — Sequence No. (b1 to 30); Control No. (bb1 to bb5)	< From analyzer to host > TS inquiry in the ID mode is made in space (for routine sample). < From host to analyzer > Sample No. is ignored for TS specification in the ID mode.
Unassigned (1 character)	Space		Space	
Position No. (3 characters)	Transfer sequence → $10^2 \cdot 10^0$ p p p — Position No. (bb1 to b35)	Transfer sequence → 10^4 10^0 p p p — Position No. (bb2 to b35)	Space	< From analyzer to host > Blank space for control sample < From host to analyzer > (1) For space, the analyzer side is followed. (2) Position No. is ignored for TS indication in the ID mode.
ID No. (13 characters)	< ID mode and sample No. mode > Transfer sequence → 10^{12} 10^0 : : : : : : : : : : : : : — ID No.		Space	(1) When ID No. is within 13 digits, it is right-justified and preceded by one or more space. (2) In the NO ID mode, the analyzer treats ID No. as a comment. (3) In transferring the analytical data of control sample in the ID mode, the ID No. of this sample is sent in space from the analyzer to host.

(3) Test Selecting Information (from host to analyzer)

Send test selecting information corresponding to sample information.

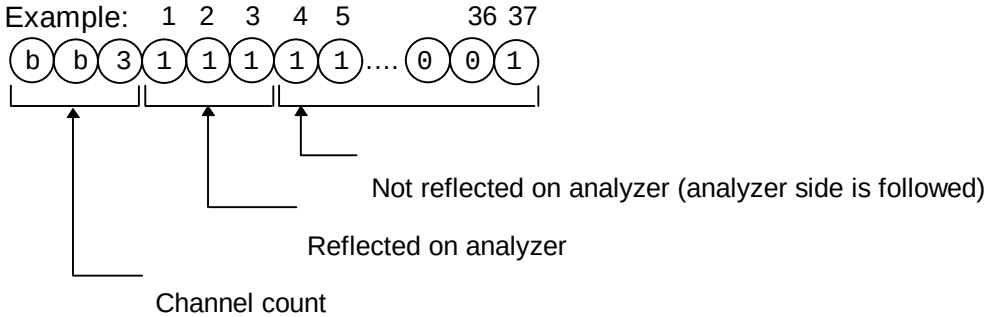


Details of Request for Each Channel

(b: Space)

	Function Character	Details of Request
Initial measurement	" Ab " " b " " Db "	0: No request 1: Normal sample volume 2: Unused 3: Unused 4: Volume determined by analyzer side (left to analyzer)

NOTES: 1. The above channel count ("bb0" to "b37") is the number of effective channels from photometry-assay channel 1. If "bb3" is specified, channels 1 to 3 are reflected on the analyzer with channels 4 to 37 ignored.
When there is at least one requested test, it is desirable to set "37."


Example: 1 2 3 4 5 36 37
b b 3 1 1 1 1 1 .... 0 0 1
Not reflected on analyzer (analyzer side is followed)
Reflected on analyzer
Channel count

The analyzer side is obeyed if test request is made in a channel number beyond the specified channel count. To avoid analysis for an unnecessary test, set channel count "37" and request for only a test to be specified.

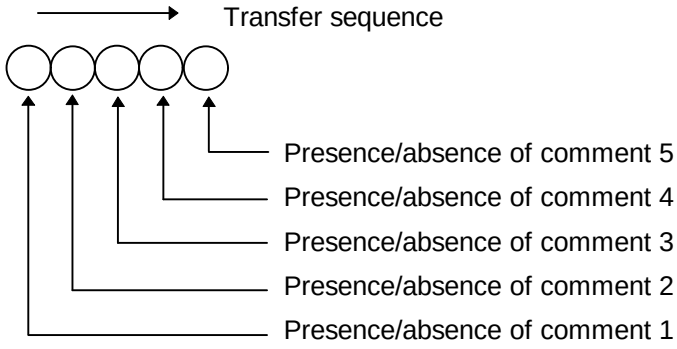
2. Request for ISE is specifiable in the 37th channel.
   (i) Specification of any other than "0" ... Select Na, K and Cl on the screen.
   (ii) Specification of "0" ... No request
   Note that it is impossible to select a request for any of Na, K and Cl from the host.

3. In request for the isozyme test or compensation test, the other test necessary for isozyme calculation or test-to-test calculation is automatically supplied for analysis, and tests added for serum indexes are transferred as well.

4. When request for the calculation test is made, judge and request the channel for the test necessary for the calculation. When request for the A/G ratio is made for example, send test selecting information considering the channels for TP (total protein) and ALB (albumin).

5. TS request for serum indexes cannot be made for each sample.
For request, specify serum index test on the parameter screen and serum indexes on the start condition screen.

(4) Comment Information (from host to analyzer)



Set "0" for all comment presence/absence information items.

16.7 Error Check Function

If the contents of the received text fall under any condition shown in Table 16-25, the analyzer judges that there is an abnormal character and outputs an alarm.

Table 16-25

<table>
<tr><th>Attribute</th><th>Item</th><th>Details of Check</th><th>Remarks</th></tr>
<tr><td>Text information</td><td>Frame character</td><td>An irrelevant frame character is received.
(For details, refer to Table 16-3.)</td><td></td></tr>
<tr><td></td><td>Function character</td><td>Function character does not correspond to sample.
(For details, refer to the contents of text in 16.2.)

Example
Analyzer HOST Analyzer HOST
" A " → " n " →
(alarm not output) (alarm output)
" A " : Routine sample
(1) An irrelevant frame character is received.
(2) In test selecting information inquiry, a function character differing from the contents sent from the analyzer to host is received.
(3) Character check in the unassigned area of text is not made on the analyzer side and alarm is not output.</td><td></td></tr>
<tr><td>Sample information</td><td>Sample No.
Position No.</td><td>Each number is outside the specified range excluding the following cases.
<table>
<tr><th></th><th>Routine Sample</th><th>Stat Sample</th></tr>
<tr><td>Disk No.</td><td>1 to 400 or space</td><td>1 to 50 or space</td></tr>
<tr><td>Position No.</td><td>1 to 35 or space</td><td>2 to 35 or space</td></tr>
</table></td><td>Error occurs when the position No. of a stat sample is outside the specified range or 0 on the stat sample position setting screen.</td></tr>
<tr><td></td><td>ID No.</td><td>
<table>
<tr><td>ID Mode</td><td>$20 to $7E (right-justified)</td></tr>
<tr><td>NO ID Mode</td><td>Same as above</td></tr>
</table>
Error occurs when the control code of each test is any of $00 to $1F.
If any test is outside the specified range, error occurs.</td><td></td></tr>
<tr><td>Inquiry information</td><td>Test selecting information</td><td>(1) Test selecting information for a routine/stat sample is any other than '0' to '4.'
(2) Channel count is outside the specified range.</td><td></td></tr>
</table>

16.8 Specifications of Communication Trace

16.8.1 Overview

This is an auxiliary function for outputting the stored data onto the printer as a logging in order to check the contents of communication between the analyzer and host. This function is selectable on the communication parameter screen.

16.8.2 Trace Data

The time point of communication execution, the direction of communication and the contents of message are stored.
The data to be stored differs between the cases below.

(1) In Normal Communication

Frame character, function character and sample information are stored. However, only frame character and function character are stored for the text without sample information (NOTE).

NOTE: Storage is made according to the following rule.
1) Text without function character
Frame character and one character after it (2 characters in total)
2) Photometry-assay calibration text
Frame character, function character, channel No., STD count and calibration alarm (8 characters in total)
3) ISE calibration text
Frame character, function character and ISE type (4 characters in total)

(2) Upon Occurrence of Any Error During Communication

The details of the error and all characters up to occurrence of the error are stored. However, if send time-out occurs during sending from the analyzer to host, only frame character, function character and sample information are stored the same as in normal communication (in (1) above).

16.8.3 Trace Data Storage Timing

(1) In any other than Transfer of Analytical Data Alone
(a) The trace function is activated after sending a text from the analyzer and receiving a corresponding text from the host (after receiving the end-of-data code).
(b) The trace function is activated upon change from [YES] to [NO] for communication trace on the communication parameter screen.

(2) Transfer of Analytical Data Alone

The trace function is activated on completion of transferring the text sent from the analyzer (after sending the end-of-data code).

16.8.4 Resetting of Trace Data

Trace data is reset when [CLEAR] is specified for "communication trace printout" on the mechanism check screen.

16.8.5 Trace Data Storage Capacity

Data of 1200 cycles max. (conversation) can be stored.

16.8.6 Other

Communication trace data is not stored under the following conditions.

(1) During printout of communication trace data

(2) During deletion of communication trace data

16.9 Hardware Specifications

16.9.1 Overview

The Model 902 can select the RS-232C interface or 20 mA current loop interface and can monitor the sent data via each interface.

(1) RS-232C

Use the connector J402 on the RSDIST circuit board provided on the rear panel of Model 902.

(2) 20 mA Current Loop

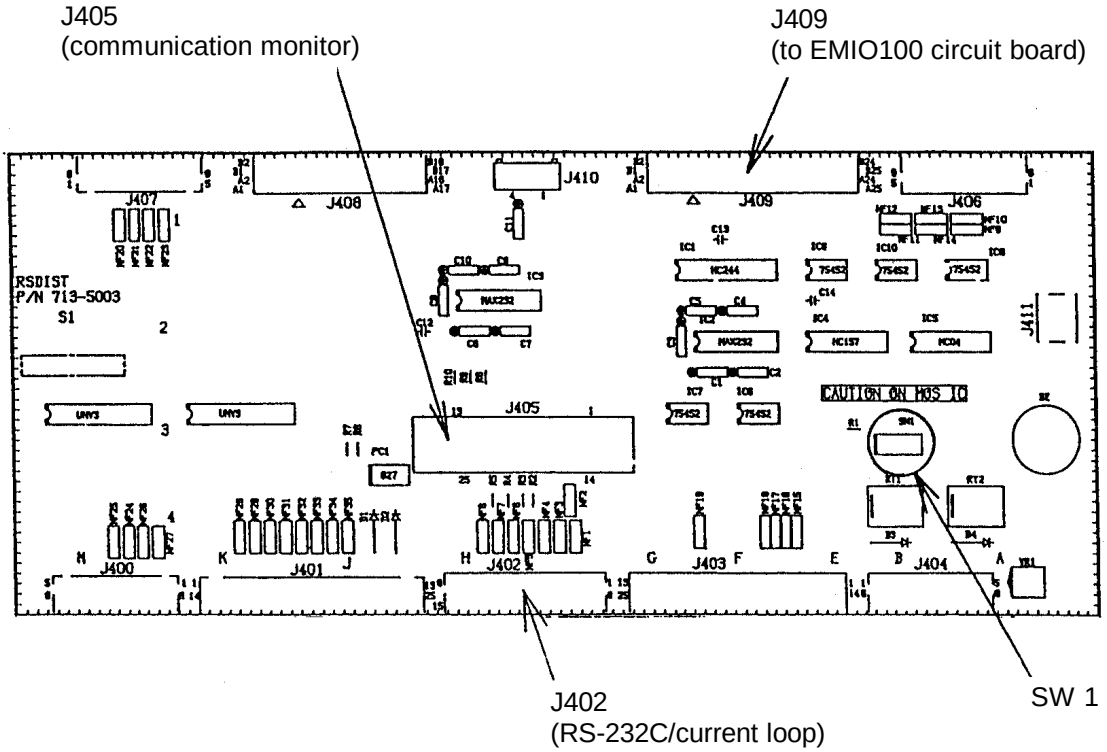
Use the same connector J402 as for RS-232C. (Either RS-232C or 20 mA current loop is selectable by switch No. 1 on the RSDIST board.)

(3) Communication Monitor

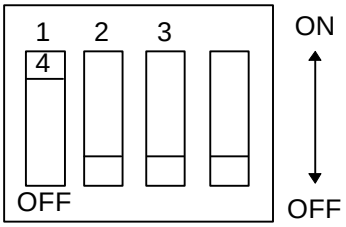
The data sent from the Model 902 can be monitored by using the connector J405 on the RSDIST board.

16.9.2 RSDIST PC Board

(1) External View



(2) Switch Setting



No. 1	ON : Current loop OFF : RS-232C
No. 2 No. 3 No. 4	Always OFF

(3) Pin Arrangement

Table 16-26 Signal Assignment

Pin No.	J402 (RDAD-15P female side)		J405 (RDBB-25S female side)	
1	SG		Unused	
2	TXD	RS-232C (from host)	TXD	
3	RXD		Unused	
4	RTS		RTS	Communication monitor
5	CTS		Unused	(RS 232C)
6	TXD +		Unused	
7	TXD -		SG	
8	RTS +		TXD +	
9	RTS -	Current loop (from host)	TXD -	
10	CTS +		RTS +	Communication monitor
11	CTS -		RTS -	(current loop)
12	RXD +		DTR +	
13	RXD -		DTR -	
14	Unused		14, 15	Unused
15	Unused			

(4) Connection Diagram

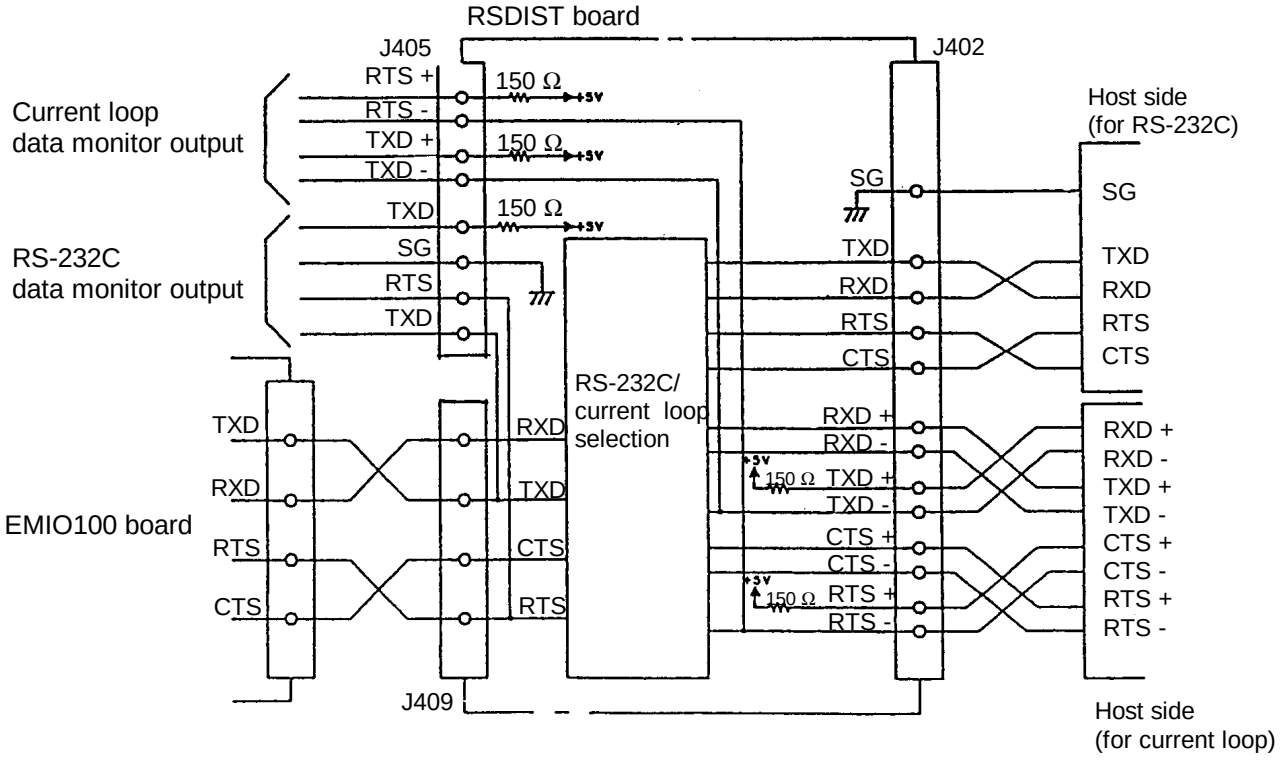


Fig. 1-16 Connection Diagram

16.9.3 Interface Signal

Table 16-27 lists the meanings of interface signals, and Tables 16-28 and 16-29 list signal levels and their meanings.

Table 16-27 Meaning of Interface Signal

Abbreviation	Signal Name	Meaning of Signal	Direction of Signal (902 side) (Host side)
FG	Frame Ground	Frame ground	
TXD	Trans Data	Transmission data	→
RXD	Receive Data	Reception data	←
RTS	Request To Send	Request to send	→
CTS	Clear To Send	Clear to send	←
SG	Signal Ground	Signal ground	

Table 16-28 RS-232C Interface Signal Level and Meaning

Signal Level / Signal Name	Positive (NOTE 1)	Negative (NOTE 1)
TXD RXD	• SPACE • Start bit • Data "0" (NOTE 2)	• MARK (no signal) • Stop bit • Data "1" (NOTE 2)
RTS DTS	• ON • Data "1"	• OFF • Data "0"
CTS	• ON • Data "1" • Data communication allowed	• OFF • Data "0" • Data communication prohibited

NOTES: 1. Positive.....Output +12 V, input +3 V to 15 V
Negative .....Output -12 V, input -3 V to 15 V
2. Data "0" and data "1" correspond to decimal numbers for the CPU to read/write data or status, respectively.

Table 16-29 20 mA Current Loop Interface Signal Level and Meaning

Signal Name	Signal	
	Current ON (20 mA)	Current OFF (0 mA)
TXD RXD	• MARK • Stop bit • Data 1	• SPACE • Stop bit • Data 0
CTS	• OFF • Data 0 • Data transfer prohibited	• ON • Data 1 • Data transfer allowed
RTS	• OFF • Data 0	• ON • Data 1

NOTE: Data 0 and data 1 correspond to decimal numbers for the CPU to read/write data, respectively.

16.9.4 RS-232C Communication

(1) Connector Position

Use the connector J402 on the rear panel of Model 902.

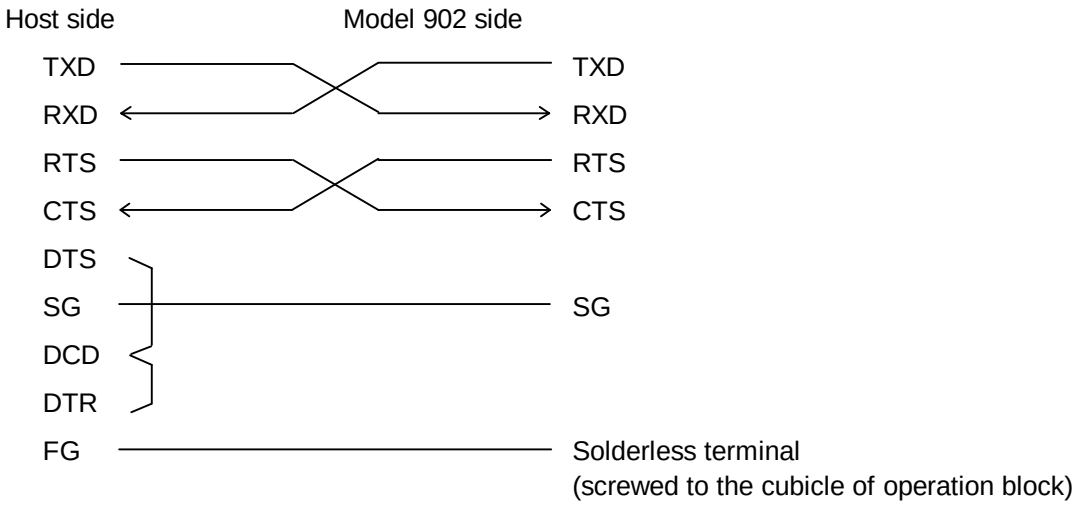
(2) Connecting Cable and Cable Length

J402 uses a 15-pin interface connector (female).
On the cable side, use the following.
HDAB-15P (made by Hirose Denki)
Cable length is limited to 15 m at maximum.

(3) Pin Arrangement

Refer to (3) of 16.9.2.

(4) Example of Connection



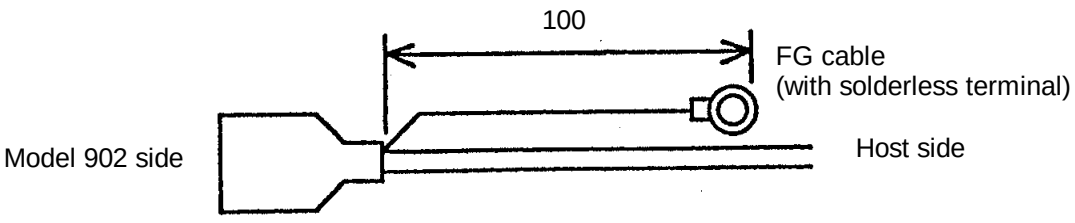
NOTE: For solderless terminal, refer to (5) below.

Fig. 16-2 Example Connection for RS-232C Communication

(5) Measure for FG

FG is not assigned to the J402 connector. So attach a solderless terminal to the FG cable of host computer and screw it on the cubicle of operation block as detailed below.

Requirements for FG cable (See Fig. 16-3.)
- Cable length: 100 mm or longer
- Solderless terminal: For M4 screw



HDAB-15S (made by Hirose Denki) or equivalent

Fig. 16-3 Requirements for FG Cable

- Fixing position
  Fix in the screw hole under J402.

16.9.5 Current Loop

Current loop is selected by turning on the switch No. 1 on the PC board. In the current loop mode, the J402 connector is used as in the RS-232C mode.

(1) Connection Diagram

Refer to (4) in 16.9.2.

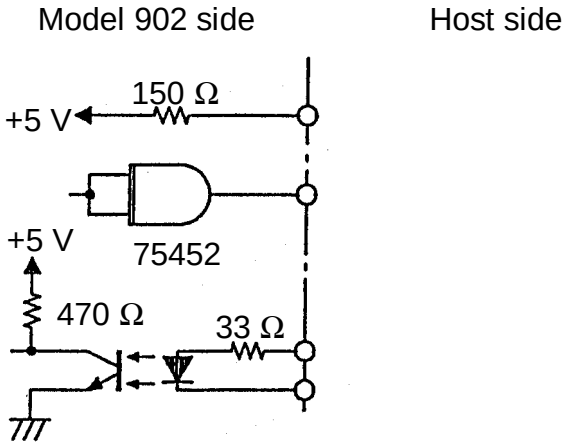
(2) Connecting Cable

The J402 connector side uses a 15-pin interface connector (female) of type RDAD-15S. The cable side should use the following.
HDAB-15P (made by Hirose Denki) or equivalent

(3) Pin Arrangement

Refer to (3) in 16.9.2.

(4) Signal Input Circuit



16.9.6 Communication Monitor

Data transferred between the Model 902 and host can be monitored by connecting a personal computer or other monitor to J405 on the RSDIST board.
For monitoring, turn off the switch No. 1 on the PC board.

(1) Connection Diagram

Refer to (4) in 16.9.2.

(2) Connecting Cable

The J405 connector side of RSDIST board is a 25-pin interface connector (female) of type SDBB-25S. The cable side should use the following.
HDBB-25P (made by Hirose Denki) or equivalent

16.9.7 Data Alarm Code List

Table 16-30 Data Alarm Code List

No.	Data Alarm	Output String	Photometry Assay				ISE				Remarks
		S I/F	Routine	Stat	Control	STD	Routine	Stat	Control	STD	
1	ADC abnormal	A	○	○	○	○	○	○	○	○	
2	Cell blank abnormal	Q	○	○	○	○					
3	Sample short	V	○	○	○	○	○	○	○	○	
4	Reagent short	T	○	○	○	○					
5	Reagent short	Z	○	○	○	○					
6	Absorbance over	P	○	○	○	○					
7	Prozone error	I	○	○	○	○					
8	Reaction limit over except 1 point	J	○	○	○	○					
9	Reaction limit over except 2 or 3 point	K	○	○	○	○					
10	Linearity abnormal at 9 points or more	W	○	○	○	○					
11	Linearity abnormal at 8 points or less	F	○	○	○	○					
12	Standard 1 absorbance abnormal	H				○					
13	Duplicate error	U				○					
14	STD error	S				○				○	
15	Sensitivity error	Y				○					

(cont'd)

No.	Data Alarm	Output String	Photometry Assay				ISE				Remarks
		S I/F	Routine	Stat	Control	STD	Routine	Stat	Control	STD	
16	Calibration error	B				○				○	
17	SD error	G				○					
18	Noise error	N					○	○	○	○	
19	Level error	L					○	○	○	○	
20	Slope error	E								○	
21	Internal standard concentration abnormal	D								○	
22	Sample value abnormal	&					○	○	○		
23	Test-to-test compensation error	C	○	○	○		○	○	○		
24	Test-to-test compensation disabled	M	○	○	○		○	○	○		Data becomes blank space.
25	Calculation test error	%	○	○			○	○			
26	Overflow	O	○	○	○		○	○	○		Data becomes blank space.
27	Calculation disabled	X	○	○	○	○	○	○	○	○	Data becomes blank space.
28	SD Absorbance error (AMAX)	>	○	○	○	⌐	⌐	⌐	⌐	⌐	Data becomes blank space.

NOTE: If any data caused multiple data alarms, the alarm registered first will be output.

16.10 Cautions on Connection with External System

(1) For connection with this protocol, adopt the point-to-point system.

(2) Although the end-of-data code is changeable on the system setting screen, the host must send the same end-of-data code as on the analyzer side. If the code does not match between them, alarm is issued.

(3) EXT is always added to the end-of-data code in each text. Whenever data beyond 256 bytes is transferred, therefore, the analyzer adds not ETB but ETX.
For the host, a frame character ':' is the final message when the data for one sample is sent in more than one text. So pay attention when taking in the data.

(4) As a rule, the analyzer sends the ANY frame to the host in response to a request from it in the following cases.
   (a) On request for analytical data transfer from the host, the relevant sample is not stored on the FD.
   (b) Analytical data cannot be read from the FD due to occurrence of an error in it during batch transfer of analytical data.

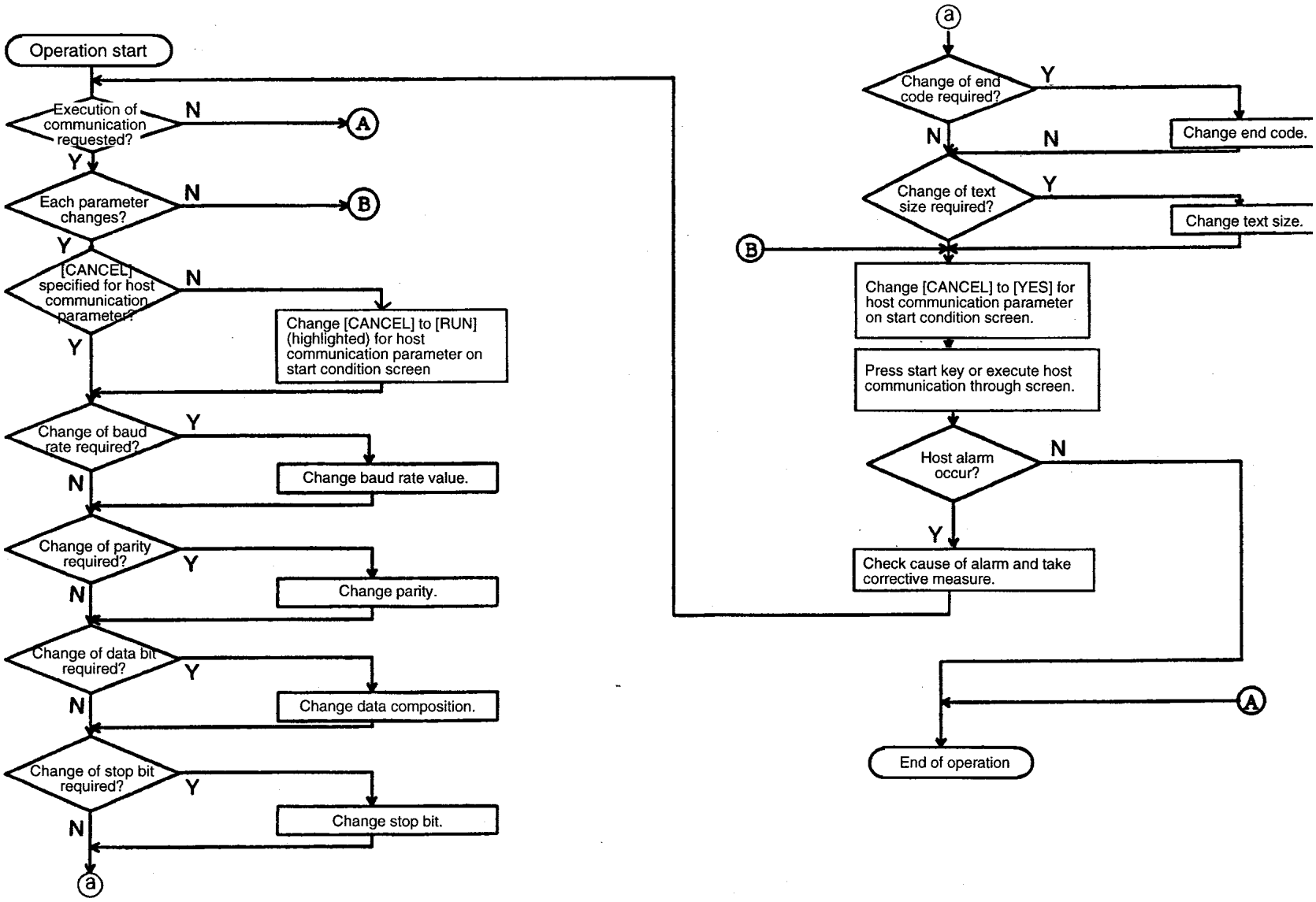
(5) The communication controller in the analyzer is initialized in the following cases.
   (a) Power supply is turned on.
   (b) [RUN] (highlighted) is specified for host communication parameter (any of baud rate, parity data bit, stop bit, end-of-data code and text length is changed through the screen). At this time, the first event request (RES, SPE) from the host is ignored. After changing a communication parameter, attention should be paid to event.

(6) If an error is detected on a text transferred from the host, the analyzer sends REP (resending request) until the normal text is received.

(7) Secure at least 100 msec before transfer from the host to analyzer.

16.11 Operation Flow Diagram

Operation flow for use of this host communication is shown below.



16.12 Supplementation

16.12.1 Glossary

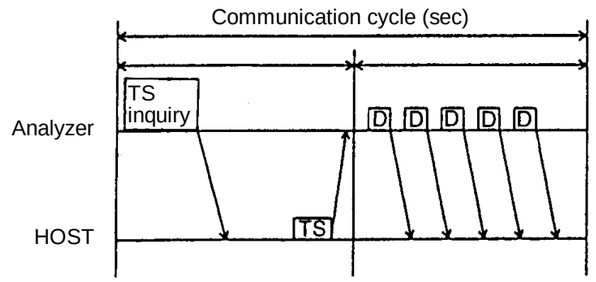
(1)	Conversation	:	An exchange of texts between the analyzer and host computer.
(2)	Cluster	:	A group of conversations between the analyzer and host computer.
(3)	Text	:	A message transferred between the analyzer and host computer.
(4)	Framing of text	:	To provide a start character and end character at the beginning and end of a text for receiving it without fail and facilitating its check.
(5)	Length of text	:	The total number of characters constituting a text.
(6)	Test selection	:	Analysis by multi-test analyzer not for all tests but for the tests selected through external instruction.
(7)	Point-to-point system	:	A system in which two instruments for data sending, receiving or processing are connected via the communication line, any other instrument is not connected between them and there is no instrument for control of data transmission for the whole system.
(8)	Response	:	Sending to one of the instruments which communicate with each other whether the other is ready for reception or not and whether the received data is normal or not, and a character to be transmitted for that purpose.
(9)	Recovery	:	To escape from a deadlock which is caused by abnormality in the sender, receiver or line.
(10)	Frame character	:	Identifies the purpose of text and functions like a command No.
(11)	Data link	:	A general term for the physical transmission path from the sender to receiver via data transmission line and the logically set data transfer path.
(12)	Data field	:	An area for the contents of a message excluding the control code, frame character and end-of-data code in a text.
(13)	Specific sample	:	An optional sample requested to the analyzer from the host.
(14)	Specific request text	:	A text which makes a request to the other side for a text having a data field. (Example: SPE, FR4, FR2, END, RES)

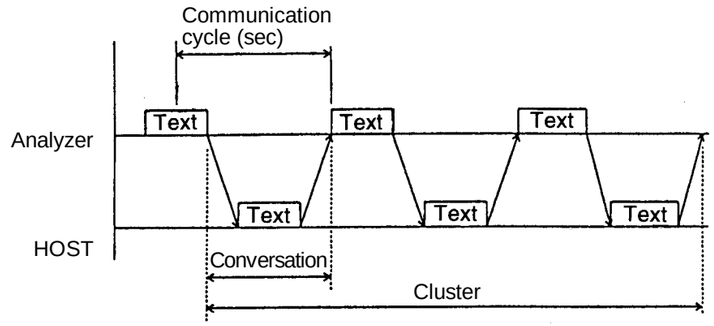
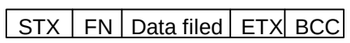
(15) Non-specific request test : A text which makes a request to the other side for a text having no data field. (Example: ANY, MOR, REP, SUS, REC)

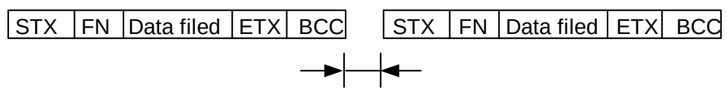
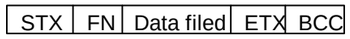
(16) ID mode : [RUN] (highlighted) is specified for barcode reader test on the SYSTEM PARAMETERS screen and [CANCEL] is specified for barcode T/S test.

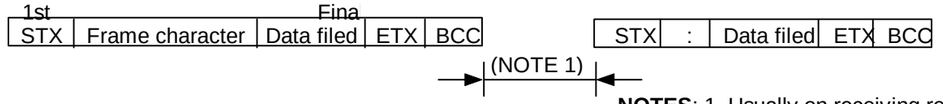
(17) Sample No. Mode : [CANCEL] is specified for barcode reader test on the SYSTEM PARAMETERS screen. Or, [RUN] (highlighted) is specified for both barcode reader test and barcode T/S test on the SYSTEM PARAMETER screen.

16.12.2 Differences in Communication Specification between Conventional Analyzers and Model 902

<table>
<tr><th></th><th>Conventional Analyzers (Model 7250, 7150, 7050, etc.)</th><th>Host Manual Drive System (Model 7170/902)</th></tr>
<tr><td>Communication timing chart</td><td> 

TS: Test selecting information
D : Analytical data</td><td> 
</td></tr>
<tr><td>Composition of message</td><td>(1) With less than 255 bytes (TS inquiry, analytical data transfer)
 

(FN: Function No.)
(2) With 255 bytes or more (analytical data transfer)
 
</td><td>(1) With less than 254 bytes (TS inquiry, analytical data transfer, other)
 

FR ..... Frame character
':' ..... Frame character indicating the fianl frame in analytical data transfer
(2) With 254 bytes or more (only transfer of analytical data)
 

NOTES: 1. Usually on receiving response from hos (within 5 sec)
2. 2 sec or more in RESULT ONLY mode</td></tr>
<tr><td>Characteristics</td><td>(1) A communication cycle is divided into the first and second halves where TS inquiry and analytical data transfer are made, respectively.
(2) Function is simple due to discrimination with real-time transfer and batch transfer.</td><td>(1) As a rule, response is made to each request.
(2) Text has a frame No. corresponding to command No. and control code (ACK, NAK) in it for communication control.
(3) Applicable to multiple jobs because there is basically no discrimination between real-time communication (communication under analysis) and batch communication (specified through screen).
(4) Because protocol need not be changed among instruments, a high maintainability is ensured.
(5) Reducing the burden of host can be expected.</td></tr>
</table>

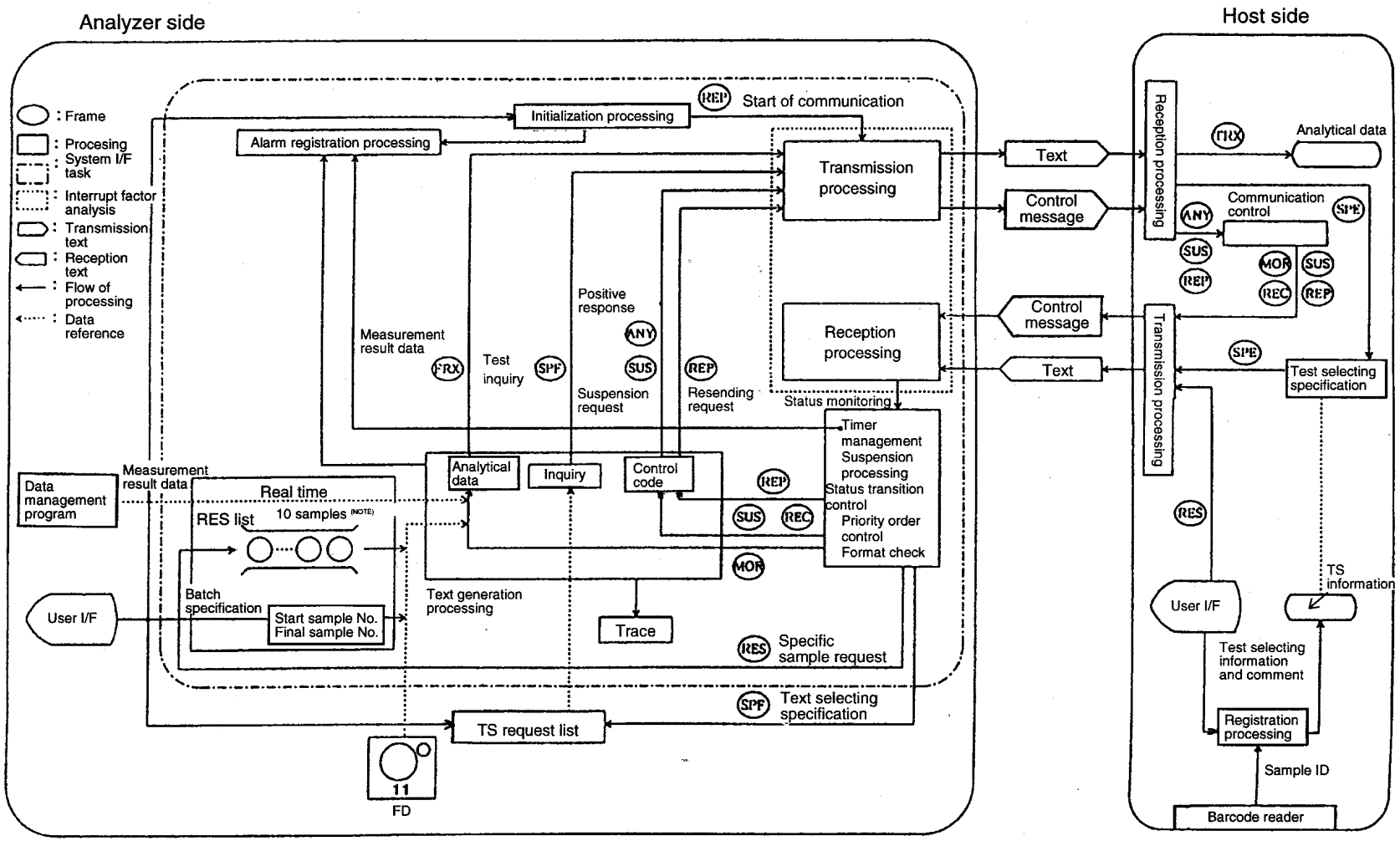
Comparison between Conventional Analyzer and Model 902 in Host Communication

			Model 7170 (7070)	Model 902
Test inquiry	S. No.	Host inquiry information	Sample No., disk position, ID (can be input through screen)	Sample No., disk position, ID (can be input through screen)
		T/S batch transfer	Possible	Possible (in routine mode only)
		Sample registration to analyzer	Unnecessary	Routine mode unnecessary Simple analysis necessary
		Handling when analyzer has T/S	Same as right	Mode selectable by system parameter 1) Full-time inquiry (priority given to host) 2) Inquiry when without T/S (same as before)
		Analysis prohibitive specification	T/S all zero	←
		S. Stop specification from host	Possible (POS = 0)	Impossible
		Host-priority function	Possible	None, time-out in 2 cycles (36 sec)
		Request for serum indexes	Possible	Impossible
		Sample volume increase/decrease, kind and age	Possible	Impossible
	ID (basically same as S. No. mode)	Host inquiry information	ID, disk position	ID, sample No. (space)
		ID read error support	• No inquiry to host • Inquiry allowed through manual ID input	Routine analysis: No inquiry to host Simple analysis: Inquiry made via ID space and position No.
Data transfer	S. No. ID	Reaction process data	Batch transfer	Real-time transfer
Data review	Retrieval via ID		Available	Unavailable
	Addition/change of ID, comment and data		Possible	Impossible
	Handling of identical sample		Routine sample: Handled in units of test (overlay) Stat sample: Overwrite (NOTE)	Routine sample: Handled in units of test (overlay) Stat sample: Same as above

NOTE: Condition: Previous data, TP 8.0, GOT 30

	Current Data	Stored Data
Over lay	TP 5.0	TP 5.0 GOT 30
Over write	TP 5.0	TP 5.0

16.12.3 Processing Flow Diagram of System Interface



NOTE: Data of up to 10 samples is stored in both ID and sample No. modes.

16.12.4 ASCII Code Tables

Table 16-31 7-Bit Roman Character Code Set

Row \ Column	0	1	2	3	4	5	6	7
0	NUL	TC_7 (DLE)	(SP)(NOTE)	0	@	P		p
1	TC_1 (SOH)	DC_1	1	1	A	Q	a	q
2	TC_2 (STX)	DC_2	99	2	B	R	b	r
3	TC_3 (ETX)	DC_3	#	3	C	S	c	s
4	TC_4 (EOT)	DC_4	$	4	D	T	d	t
5	TC_5 (ENQ)	TC_8 (NAK)	%	5	E	U	e	u
6	TC_6 (ACK)	TC_9 (SYN)	&	6	F	V	f	v
7	BDL	TC_{10} (ETB)	"	7	G	W	g	w
8	FE_0 (BS)	CAN	(	8	H	X	h	x
9	FE_1 (HT)	EM	)	9	I	Y	i	y
10	FE_2 (LF)	SUB	*	:	J	Z	j	z
11	FE_3 (VT)	ESC	+	;	K	[	k	{
12	FE_4 (FF)	IS_4 (FS)	,	<	L	¥	l	|
13	FE_5 (CR)	IS_3 (GS)	-	-	M	]	m	}
14	S0	IS_2 (RS)	.	>	N	^	n	–
15	S1	IS_1 (US)	/	?	O	_	o	DEL

NOTE: (SP) is not printed actually.